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# USSR Report

## ECONOMIC AFFAIRS

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14 November 1985

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ECONOMIC AFFAIRS

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Moscow PLANOVYE KHOZYAYSTVO in Russian No 8, Aug 85 pp 9-17

[Article by L. Voronin, first deputy chairman, USSR Gosplan: "Improving the Economic Mechanism--An Indispensable Condition for Shifting the Economy to the Intensive Path of Development"]

[Text] Objective changes in the relationship of reproduction factors in the coming period and in the long term make urgently necessary to shift our economy to the intensive path of development. This was confirmed once again in the course of the elaboration of a long-term social and economic strategy.

For more than 2 years now, the USSR Gosplan has been working on the problems of the future development of the national economy. For the first time in the practice of long-term planning, a Concept for the Economic and Social Development of the Country Through the Year 2000 has been drawn up. It assessed the current level of development of our society, formulated the main social and economic tasks for the coming period and outlined ways to resolve them. The fundamental tenets of the concept have been made the basis of the draft of the Main Directions of the Economic and Social Development of the USSR for the Years 1986-1990 and for the Period Through the Year 2000.

The analysis and calculations carried out in the course of the preparation of these documents show that the social and economic situation in the 1980's and 1990's is fundamentally different from that of prior periods. Taking this into account and proceeding from the objective capabilities of our economy, long-term tasks are being formulated. The country has all types of raw materials and energy resources, a powerful production potential and a vast army of qualified workers, engineers and scientists. Many social problems have basically been solved. Among them are the transition to universal compulsory secondary education, the satisfaction of the public's needs for basic food and industrial commodities, the services of the public health system, etc. The housing problem is being resolved at a higher level. We are very close to fully providing the public with family housing. It is precisely the reaching of these boundaries and the scale and degree of maturity of our economy that permit us to set and carry out important new tasks.

It is also necessary, however, to consider some negative factors and tendencies complicating the development of the economy, factors whose influence will continue in the future. It primarily involves the sharp reduction in the increase in the most important types of raw materials and energy resources, for many of which the maximum economically justifiable production and extraction levels have been reached. This relates mainly to several energy sources and construction materials. Whereas previously at least 70 percent of the national economy's demand for metal was met through the natural increase in its production and only 30 percent through an increase in the quality of metal products and the effectiveness of planning and design solutions, calculations show that by the year 2000 this ratio must be reversed.

There will be practically no increase in the number of employees in physical production. Ecological problems will be aggravated and their solution is linked with significant expenditures. And the production potential that has been created requires substantial means to keep it functioning smoothly.

In the coming period, there will be a sharp increase in the interdependence of social and economic problems, narrowing the number of viable options available and reducing the possibility of an economic maneuver, of replacing some growth factors with others. In a number of very important areas, we have practically no alternatives. Thus, the diversion of substantial assets to keep existing production efficient and the sharp increase in expenditures for environmental protection are making impossible to achieve future growth in labor productivity through an increase in its capital-labor ratio, as in the ninth and current Five-Year Plans.

In connection with a shift to the east in the extraction of most minerals and the exhaustion of the "rich" ores of many types of metals, per-unit expenditures are increasing for the production of construction materials and energy sources. The possibilities for the further expansion of sown areas have practically been used up.

Estimates of the increases in manpower resources for the period through the year 2000 indicate that they will slow substantially in comparison with the period of the three preceding five-year plans.

Under these conditions, only the intensification of production, that is, the maximum effective use of the established production potential, fuel, raw materials, and material and manpower resources will ensure the resolution of the problems objectively facing our country. However viable extensive methods of management may have been, it is essential to renounce them categorically. At the April (1985) CPSU Central Committee Plenum and the June conference in the CPSU Central Committee on questions of the acceleration of scientific-technical progress, it was noted that to a decisive degree the development of Soviet society will be determined by qualitative shifts in the economy, by the shifting of to the track of intensive growth, and by a general increase in efficiency. For an increase in economic efficiency, it is possible and necessary to advance in several directions, making use of various factors, including the mobilization of internal production reserves through a better utilization of equipment and a reduction of down time, the establishment of

order in the organization of the production process and in the provision of evenness in work, and the strengthening of discipline in planning, technology and labor.

Ahead are fundamental transformations destined to encompass all sectors of the economy and all walks of life in society. New approaches are needed in investment and structural policy, in the development of science and technology and the improvement of the economic mechanism, and in the strengthening of order and the raising of the responsibility of all for the assigned work.

The main path for the reorganization is that of a more intense and comprehensive utilization of the advantages of the socialist economy.

One of the measures being taken in this direction is the large-scale economic experiment being carried out in industry and domestic services in the expansion of the rights of associations and enterprises in planning and economic operations and in increasing their responsibility for work results.

Beginning 1 January 1984, 700 enterprises of five industrial ministries were participating in the experiment. In August 1984, the CPSU Central Committee Politburo discussed the initial results and noted the positive influence of the new working conditions on the results of the economic activity of enterprises. The CPSU Central Committee Politburo agreed with the proposals of the ministers and councils of ministers of the union republics on the extension of the management conditions to enterprises in a number of sectors, in particular machine building, ferrous metallurgy, food and light industry, local industry and domestic services to the population. Thus, beginning in 1985, new associations and enterprises and their labor collectives as well as party, trade-union and Komsomol organizations were included in the experiment.

In speaking of the experiment, it is above all necessary to note its main tasks. Everyone knows that for many years the party has held to the course of combining centralized planning leadership with an increase in the interest of enterprises and organizations in improved production efficiency and in increasing the role of economic methods of management. For a long time, however, it was not possible to achieve a fundamental breakthrough in this area.

The economic experiment called the implementation of the following measures: increasing the role of associations and enterprises in the elaboration of plans in all stages of planning and a heightening of their responsibility for ensuring the production of output for the national economy and the public; increasing the significance of economic standards as an important means for having the five-year plan influence the economic activity of associations and enterprises (the application of these standards has the purpose of encouraging the better utilization of all types of resources and, at the same time, of guaranteeing the enterprises stable management conditions, under which the amount of funding that they receive for the remuneration of labor and for social development will be made directly dependent upon the final results of their work); raising the interest of labor collectives in working with fewer workers, in saving material and financial resources, and in the overall strengthening of cost accounting principles; extending the rights and

possibilities of associations and enterprises to increase the technical level of production through the use of the enterprises' own assets through cost accounting and to accelerate scientific-technical progress; enhancing the role of the fund for social and cultural measures and housing construction in resolving the tasks in the social development of labor collectives. The increase in the fund is made directly dependent upon the final indicators for the work of the enterprises. It is intended that the fund for social and cultural measures and housing construction will gradually become one of the main sources for improving the living conditions of workers and their family members. In other words, basic to the experiment is the increase in the role of economic leadership methods and of controls and incentives to reduce the area of the application of primarily administrative methods where it is possible and expedient to do so. This involves combining the two methods and deciding which of these must be decisive in one situation or another, since in practice the two methods are applied together and can be expressed in the same indicators.

When economic methods are used, the interest and responsibility of enterprises for the results of their work rise substantially. Under the influence of economic controls and incentives, they themselves choose the methods for the use of resources that are most effective for them and the state in achieving the goals set by the plan and they actively participate in planning in all stages of the elaboration of the plan.

However, the increase in the interest and responsibility of enterprises for the results of their work is unavoidably linked with granting them the corresponding rights and resources and a certain degree of decentralization in the management of resources. The experiment is aimed precisely at the search for such specific forms for the optimum combination of different management methods that will provide for a maximum increase in the efficiency of the reproduction resources used and for a turning toward intensification.

An analysis of the accounting data for 1984, local checks and ministerial reports indicate that the course of finding the optimum combination of centralized leadership with an expansion of the rights of enterprises as well as their independence and responsibility for work results is paying off.

First of all, it was possible to reorient enterprises toward the fulfillment of contractual deliveries rather than toward an increase in the overall volume of production, as had been the case prior to the start of the experiment. As a result, in 1984 the Ukrainian SSR Ministry of the Food Industry, the Belorussian SSR Ministry of Light Industry, and the Lithuanian SSR Ministry of Local Industry for the first time completely fulfilled deliveries by all enterprises. In the Ministry of Heavy and Transport Machine Building and the Ministry of the Electrical Equipment Industry, the number of ministries fulfilling 100 percent of deliveries doubled in comparison with 1983, and the volume of shortfalls in the delivery of output declined to one-sixth of the 1983 level in the Ministry of Heavy and Transport Machine Building and to one-third of the 1983 level in the Ministry of the Electrical Equipment Industry.

These positive results are due to the following changes in the economic mechanism. In the first place, the indicator of the sale of output taking into account the fulfillment of contracts has become one of the basic indicators in the evaluation of the work of enterprises and associations. The formation of incentive funds and the awarding of bonuses to workers are directly linked to their fulfillment.

Secondly, the lengthening of the period of the work on the plan had a substantial impact on the improvement of the fulfillment of deliveries. The USSR Gosplan and the USSR Gosnab took measures to have the drafts of the basic planning indicators and limits reach the enterprises earlier than usual. This increased the participation of enterprises in the elaboration of the draft plan for 1984. Thus, in the preplanning period, the enterprises of the Ukrainian SSR Ministry of the Food Industry presented proposals on increasing the volume of production in 1984 by 320 million rubles. Proposals on increasing the volume of production and improving quality indicators were also received from enterprises of other ministries participating in the experiment.

The progress in the improvement of planning continued. Thus, the draft plan for 1985 was presented to the associations and enterprises of the Ministry of Heavy and Transport Machine Building and the Ministry of the Electrical Equipment Industry in July and August 1984, which made it possible to prepare production in time, to receive delivery orders earlier, and to begin the contracting campaign. Measures are also being taken to create the necessary conditions for the development of the draft plan for 1986. For these purposes, in May 1985, the ministries received control figures and economic standards for the development of the drafts of the plan for the first year of the new five-year plan.

Thirdly, the conversion of the indicator of the fulfillment of an amount of output sales considering deliveries into the basic indicator for the evaluation of the work of enterprises dictated the reorganization of intraplant planning and management in the fulfillment of a developed products list of output at the times and in the quantities provided for by contracts.

A positive feature in the work of enterprises is the active participation of the entire labor collective and not individual services--as was formerly the case--in adhering to the schedules for the issue of components and units and in accumulating the essential complete stocks for the timely fulfillment of contractual obligations.

In the course of the experiment, then, it was indeed possible to raise the interest and responsibility of associations and enterprises in meeting the needs of the national economy and the population with their output.

An important success of the experiment is the raising of the interest of enterprises in increasing labor productivity and in working with fewer employees. The ministries participating in it overfulfilled the goals for increasing labor productivity and obtained the entire increase in output through the given indicator. working with fewer employees than the under the plan and last year's level. In the associations and enterprises of five

ministries, the increase in the volume of production was achieved with a reduction of 3,000 industrial production workers (see table).

| Ministry                                      | Rates of Increase<br>in Labor          |        |                     | Output Gain<br>Through an<br>Increase<br>in Labor<br>Productivity | Average<br>Scheduled<br>Number of<br>Industrial<br>Production<br>Personnel |  |  |
|---|--|--------|---------------------|---|--|--|--|
|   | Productivity Over<br>the Previous Year |        |                     |   |  |  |  |
|   | Plan                                   | Actual | Plan<br>Fulfillment |   |  |  |  |
| Heavy and<br>Transport<br>Machine<br>Building | 104.7                                  | 105.3  | 101.0               | 100   | 99.4   |  |  |
| Electrical<br>Equipment<br>Industry           | 105.1                                  | 107.4  | 102.0               | 100   | 99.2   |  |  |
| Ukrainian SSR<br>Food Industry                | 99.1                                   | 101.9  | 103.0               | 100   | 99.5   |  |  |
| Belorussian SSR<br>Light Industry             | 102.5                                  | 105.8  | 103.0               | 100   | 99.2   |  |  |
| Lithuanian SSR<br>Local Industry              | 102.4                                  | 104.7  | 102.0               | 100   | 99.5   |  |  |
| All industry                                  | 103.4                                  | 103.8  | 100.4               | 93  | 99.6   |  |  |

The experiment lays the groundwork for achieving these results. The wage fund is determined by the enterprises under stable standards, and the entire savings remains at their disposal and can be used to set additional payments and allowances for high-quality and highly productive labor.

This approach to the determination of the size and to the use of the wage fund made the enterprises interested in increasing this fund while reducing the number of employees.

There was further development of brigade forms of organizing and remunerating labor, the combining of jobs increased, and the loss of working time declined. In 1984 in the Ministry of Heavy and Transport Machine Building, for example, worker membership in brigades reached 76 percent and the number of employees in cost accounting brigades with payment according to final results nearly doubled. In the Ukrainian SSR Ministry of the Food Industry, 85 percent of the workers are employed in such brigades, as are 75 percent of all of the sector workers in the enterprises of the Lithuanian SSR Ministry of Local Industry.

Substantial progress took place in expanding the combining of jobs. In the Ukrainian SSR Ministry of the Food Industry, for example, this made it possible to free up 2,100 people and the number of employees combining jobs increased by 30 percent in 1 year.

In all of the ministries participating in the experiment, losses of working time fell by 15 to 25 percent, the turnover of personnel declined in most of the ministries, and there was an improvement in the standardization of labor. As a result, the rates of growth of average wages at enterprises were above the plan while achieving a savings. In five ministries in 1984, according to the USSR Gosbank, a saving of 27 million rubles in the wage fund was obtained after payment of all additional payments and allowances and there was a reduction in the expenditure of wages per ruble of produced output everywhere except in the sugar industry and the oil and fat industry of the Ukrainian SSR Ministry of the Food Industry. As for the two above-mentioned sectors, the results of the agricultural year had a negative impact on their work.

For all ministries, the increase in labor productivity exceeded the increase in the average wage.

Thus, under the conditions of the experiment, labor collectives attaining good final results and above all an increase in labor productivity are put in a better position. In our opinion, the new economic mechanism is opening up broad possibilities for the accelerated accomplishment of tasks in the social program through the utilization of the internal means of labor collectives.

Under the new conditions, the course of increasing the role of the production development fund has been received positively. This was reflected in a rather complete assimilation of the limit of noncentralized capital investments in five ministries. In 1984, the limit was 90 percent utilized in the Ministry of Heavy and Transport Machine Building and the Ministry of the Electrical Equipment Industry, 116 percent in the Belorussian SSR Ministry of Light Industry, and 100 percent in the Ukrainian SSR Ministry of the Food Industry and the Lithuanian SSR Ministry of Local Industry.

The production development fund was used most effectively at enterprises producing consumer goods. The Belorussian SSR saved the labor of more than 3,500 people, obtained more than 70 percent of its increase in output, and reduced the production cost of output by 9 million rubles as a result of retooling and an increase in labor productivity. In the Ukrainian SSR Ministry of the Food Industry, 4,400 workers were freed, the production cost was reduced by 22.6 million rubles, and 43 million rubles in fixed capital (123 percent of the plan) was introduced through noncentralized capital investments; this fixed capital will ensure an additional output amounting to 30 million rubles annually in retail prices. In 1984, expenditures for retooling and reconstruction amounted to more than half of total capital investments.

Enterprises participating in the experiment achieved positive results: the quality of output was improved, new products were put into production, and the production of consumer goods was increased. Thus, in the Belorussian SSR Ministry of Light Industry, there was an 18 percent increase in output with

the Emblem of Quality and a 39 percent increase in output with the mark "N" (new good), and the output of fashion items delivered to trade at contract prices increased by a factor of 2.5.

In 1984, the Ministry of Heavy and Transport Machine Building put 184 new products into production compared with 82 in 1983 and it phased out 57 obsolete machines. In 1984, in accordance with the new order, 168 machines were certified, of which 157 were assigned to the highest category, including 34 products of very great importance to the national economy.

In June 1985, the CPSU Central Committee Politburo discussed the question of further developing new methods of management and increasing their impact on the acceleration of scientific-technical progress. It was noted that the work of labor collectives was improved as a result of the carrying out of the economic experiment to extend the rights of production associations and enterprises and to raise their responsibility. An important step was taken on the way to the establishment of an integral system of managing the national economy.

The decree adopted by the CPSU Central Committee and USSR Council of Ministers in this question specifies the directions for the further improvement of the economic mechanism in accordance with the decisions of the April and July (1985) CPSU Central Committee plenums and the directions given at the conference in the CPSU Central Committee on questions involving the acceleration of scientific-technical progress. It is planned to do even more to enhance the interest of labor collectives and all links of the national economy in increasing the efficiency and technical level of production and the quality of output. Enterprises have significantly greater possibilities to utilize the production development fund and the fund for social and cultural measures and housing construction. The list of ministries to be put under the new management conditions at the beginning of 1986 has been expanded.

Taking into account the proposals of ministries, departments, and the councils of ministers of the union republics, there are plans to complete the transfer of the associations and enterprises of those sectors where the experiment has already begun, essential experience has been gained, and the corresponding methodological and standardized documents and precepts have been determined and worked out for the new ways of working.

However, the extension of the sound precepts of the experiment to a significant number of industrial sectors does not mean that the economic mechanism is not in need of further improvement. In the future as well, it is necessary to continue the search for the most effective forms and methods of increasing the impact of the economic mechanism on the acceleration of technical progress and the intensification of production.

In this connection, measures have been specified for the further improvement and development of the new management methods. In the first place, the impact of the economic mechanism on scientific-technical progress is becoming greater. Thus, in the area of the economic stimulation of the increase in the technical level and quality of output, there are plans to enlarge the role of prices in the renewal of output and in raising its technical level and

quality. For this purpose, for products certified in the highest quality category, it is proposed that additions to the wholesale price be established at up to 30 percent of the economic efficiency and maintained if the products measure up to the world level and are certified in the highest quality category.

For the purpose of establishing economic conditions that would make the production of obsolete and inefficient output disadvantageous for enterprises, the system for the application of penalties on wholesale prices will be tightened up. In case of a violation of the established deadlines for renewal in the production of goods classified in the first quality category according to the results of certification, the enterprises will have to pay into the income of the state budget a penalty of 5 percent of the wholesale price the first year, 10 percent the second year, and 15 percent the third year.

It is essential to reinforce the impact of pricing on goods delivered for export and to establish incentive allowances according to its efficiency. The enterprises have greater rights and responsibilities in the utilization of allocations in foreign exchange received for the delivery of goods for export. A system of economic measures is being introduced to increase the impact of the economic mechanism on the expansion of integrated deliveries of equipment.

At the same time, it is planned that the USSR ministries and departments and the councils of ministers of the union republics should receive the targets for the production of goods in physical terms by 10 August of the year preceding the plan year and the funds for material-technical resources by 1 September. This measure should help ensure the timely preparation of the production of the output essential to the national economy and the manufacture of new highly efficient products and progressive technologies.

The following measures are planned in the area of the formation and utilization of the means for the retooling of production resources.

In the first place, provide for the formation of a fund for the development of production associations and enterprises according to standards stable over the five-year period as a function of the level of the utilization of fixed production capital and the results of economic activity.

Secondly, amplify the possibilities of associations and enterprises in carrying out measures in the technical improvement of production. For this purpose, the role of the production development fund and bank credits is increased and the conditions for the drawing up of documentation on the carrying out of measures through the indicated means are simplified substantially. The enterprises and associations receive more rights in the utilization of the assets of the fund for the preparation of the production of new equipment and the introduction of progressive technology as well as to compensate for increased expenditures for the production of new goods in the period of its assimilation.

The managers of enterprises are permitted to redistribute the assets of the production development fund and the unified fund for the development of science and technology.

Thirdly, extend the rights of enterprises in the area of the confirmation of plans for retooling through the development fund. Specify that the drafts of the plans for the retooling of enterprises, the drafting and estimating documentation and the lists of titles for measures being carried out by means of the assets of the production development fund and credit are worked out and confirmed independently by production associations (enterprises) for the five-year period.

Fourthly, simplify the beginning of the financing of work done through the development fund. To finance measures in retooling from the assets of the production development fund, the enterprises present to the institutions of the appropriate banks an excerpt from the plan that they have confirmed for retooling in the planned year and estimates for specific types of work and expenditures as well as--when credit is received--calculations of the economic effectiveness of the specified measures.

Fifthly, improve the material and technical support of the measures being carried out with the assets of the production development fund and bank credits.

The development of the plans for material and technical supply by USSR Gosplan, USSR Gossnab, ministries, departments and other organizations must begin with the complete top-priority consideration of the work in retooling through the assets of the production development fund. The provision of the needs for equipment and other material resources for new construction will be considered only after the requests of enterprises for the indicated resources for the retooling of active production are met.

Also foreseen after 1987 is the meeting of the needs for material and technical resources (with the exception of imported equipment) for the accomplishment of work through the means of the given fund, carried out using the direct-labor method directly through the territorial authorities of USSR Gossnab according to the orders of production associations (enterprises) in accordance with drafting and estimating documentation. Through its territorial authorities, it is essential that USSR Gossnab determine the requirement for equipment and material resources for the indicated work and that it present this information to USSR Gosplan within the established time periods.

In the same way, provision is made for the material and technical supply of the construction of nonproductive facilities carried out through the assets of the fund for social and cultural measures and housing construction.

For the purpose of concentrating incentive means on the stimulation of scientific-technical progress and taking into account the accumulated experience, it is planned to establish a unified economic incentive fund (apart from the wage fund) in the associations and enterprises. Measures will also be carried out to reduce the economic incentive fund in those collectives that allowed the delivery of poor-quality goods to consumers.

A system is being introduced to increase the stimulating role of bonuses to leading workers of associations and enterprises in accelerating scientific-technical progress and the fulfillment of contractual deliveries, including for those export. The role of the fund for social and cultural measures and housing construction in carrying out the tasks of the social development of labor collectives is being enhanced. In the 12th Five-Year Plan, as the essential groundwork is laid, the assets of this fund must become for the active enterprises and associations working under the new management conditions one of basic sources of financing for the construction and maintenance of dwellings, children's institutions, dispensaries, Pioneer camps, and other nonproductive facilities. As a rule, centralized sources of financing for the construction of nonproductive facilities will be allocated in the plans of ministries and departments only to satisfy the needs of labor collectives newly put into operation and of expanding enterprises, where necessary.

The increase in the funds for social and cultural measures of associations and enterprises is to be accomplished within the limits of total appropriations for these purposes through a corresponding reduction of centralized sources.

#### Intensification Process Analyzed

Moscow PLANOVYE KHOZYAYSTVO in Russian No 8, Aug 85 pp 18-26

[Article by L. Abalkin, corresponding member of the USSR Academy of Sciences: "Intensification and Economic Growth"]

[Text] The program formulated by the party for the acceleration of the country's social and economic development on the basis of scientific-technical progress calls for an abrupt turn toward the intensification of public production. It proceeds from the necessity, as the April (1985) CPSU Central Committee Plenum emphasized, of achieving a new qualitative state of the society, in the broadest sense of the word.

A profound qualitative reorganization is always accompanied by the development of new approaches, which requires a critical interpretation of accumulated experience and the rejection of the stereotypes in economic thinking and action of the past. And the more serious the impending reorganization is, the more urgent is this task. Its successful fulfillment presupposes the theoretical and above all the political and economic interpretation of the new conditions and prospects for the development of the economy.

In putting forward the task of accelerating social and economic development, said M.S. Gorbachev at the CPSU Central Committee conference on questions in the acceleration of scientific-technical progress, the party's Central Committee is not simply aiming at an increase in the rate of growth of the national economy. It is a matter of a new quality in our development, a rapid advance in strategically important areas, a structural reorganization of production, a transition to intensive tracks and efficient forms of management, and a more complete resolution of social problems.

The new quality of economic growth is inseparably linked with the intensification of public production. In examining these questions, it is first of all necessary to determine what is meant by this process of intensification. In regard to its content, one can speak in two quite different senses. Their confusion frequently produces unnecessary arguments and ambiguous evaluations of contemporary as well as past economic processes.

In the first sense, intensification means an increase in the intensity of efforts. This relates to an increase in the intensity of live labor, an acceleration of technological processes, a greater load on production funds, additional commitments of assets to the cultivation of the land, etc. None of these paths of intensification is a special feature of the current stage of economic development. They took place in the past and they will occur in the future as well.

Intensification has, however, another meaning related to the transition to a qualitatively new type of expanded reproduction. This transition has a sharply defined historical framework, in connection with which one speaks of the completion of the transition of the economy to the track of intensive development. In the intensive type of expanded reproduction, economic growth occurs mainly through the utilization of qualitative factors. It is characterized by an increase in the science-content of production, high rates of technical renewal, dynamic structural transformations, and an increase in the social orientation of the economy. As a whole, the concept of the intensive type of reproduction is used to define the totality of the profound qualitative changes dictated by the contemporary stage of scientific-technical, economic and social progress.

All of this presupposes profound qualitative transformations in productive forces, corresponding changes in production relations, and a reorganization of planning and management and the entire economic mechanism. The intensification of the economy is an integral part of the general party line on the improvement of the society of developed socialism. The more successfully it is carried out, the more the historical advantages of the socialist economic system will be revealed.

The transition to a qualitatively new stage in the development of the economy has its own particular characteristics. One of them relates to the evaluation of the established approaches, criteria, forms and methods of management. It is now becoming clear that much that was long considered to be universal is in reality only specific to a particular historical stage. Hence the necessity for a theoretical analysis of these problems and the development of scientific recommendations for the improvement of the economic mechanism.

All of this relates primarily to the understanding of the characteristics of economic growth under the conditions of intensification. Whereby it is certainly necessary in its analysis to bear in mind that we are now dealing with a large-scale mature economy. The inherent laws of its growth differ substantially from those of a developing economy that is just forming. This fact must be taken into full account in developing and carrying out structural and investment policy.

Under the conditions of a developing economy, the increase in public production was inseparably tied to the large scale of new construction, which is natural and proper. Today a different approach is needed and, as was said at the conference on questions of the acceleration of scientific-technical progress, it is important to renounce without hesitation the stereotype from the past that considered new construction to be the principal method of expanding production, at the same time that many active enterprises went long years without being retooled.

Naturally, it is not possible to get long without new construction but the emphasis should be on the reconstruction and retooling of production. In this connection, it is planned in the next few years to increase the share of funds directed to the indicated goals from one-third to at least one-half of the overall volume of capital investments.

A large-scale developed economy gives rise to additional new resources and sources of economic growth, which is related primarily to the establishment of an enormous production potential. The role of the amortization fund in the development and technical improvement of production is increasing. The total sum of depreciation allowances in the national economy amounted to 29.1 billion rubles in 1970, 49.9 billion in 1975, 72.7 billion in 1980, and 90.3 billion rubles in 1983 and their respective percentages of national income and capital investments in these same years were 10.2, 13.7, 16.0 and 16.8; and 36.1, 51.6, 66.9 and 62.7.

The skillful and rational use of these enormous resources is important for the intensification of the economy.

The changed conditions are also reflected in the rates of economic growth. Under present-day conditions, to overcome the negative tendencies that arose in the late 1970's and early 1980's, it is urgently necessary to speed up economic and social development. At the same time, however, one must consider a number of circumstances, especially the characteristics of economic growth under the conditions of intensification given a large-scale developed economy, when immense material resources are drawn into circulation every year. Their further increase is limited and sometimes inopportune. And it does not boil down to limitations superimposed by factors of nature. The role and importance of the economy as a crucial source for providing the needs of the national economy for raw materials and fuel and energy resources are steadily growing, and the possibilities and significance of the secondary use of material resources are increasing.

Naturally, this is also reflected in the overall rates of growth of industrial production, which are no longer adequately able to reflect the full complexity of the processes of economic growth. Therefore, when one speaks of increasing the rates of growth, it is necessary to have a clear idea of what rates are involved. In other words, one should select those indicators that can most fully and accurately reflect the singularity of economic growth under the conditions of the intensification of public production.

It appears that it is possible to distinguish three groups of indicators. They are the indicators:

- of the efficiency of production, especially labor productivity;
- of scientific-technical progress, the speed of technical renewal, and the quality of goods produced;
- characterizing final national economic results, primarily national income, and the execution of social tasks.

These are particularly the indicators that must become the main object of planning control and one should focus cost accounting controls, engineering thought and the entire force of socialist competition on increasing them. As for gross and volume indicators, they must lose their dominant role and move to the category of calculating indicators. This applies not only to the value indicators but to a considerable extent to the natural indicators as well, since the production program of enterprises and associations must increasingly be established on a contractual basis.

Scientific-technical progress is having a decisive impact on intensification. Life itself commands that it be accelerated substantially and, at the same time, it is putting new and stricter demands on the selection of scientific-technical projects, studies and solutions. This is determined by the changed conditions of economic growth and by the nature of the tasks being carried out at the current stage.

At the present time, the national economy has at its disposal a very significant technology in quantitative terms. It is enough to say that in the number of units of metalworking equipment we exceed the United States, FRG and Japan taken together. In many cases, there are more machine tools than machine operators. It is clear that under these conditions a further quantitative increase in such equipment is ineffective and inopportune. The main thing today is to bring about a significant acceleration in the renewal of the stock of machine tools and to improve its quality.

In resolving the issue of new machines, mechanisms and instruments, we usually begin by comparing them with those now in operation. And if they turn out to be more productive and better in some parameters or others, then the question of their production is decided unequivocally. It seems, however, that the criterion of a comparison with existing equipment belongs to the past. Today another criterion must be used, that of conformity to the latest achievements of science and the highest world standards. For to produce something that does not measure up to these standards means to reproduce technical backwardness for a number of years into the future.

The task set by the party of reaching the highest world level of labor productivity in a relatively short time presupposes stricter demands on new technology. An especially important task, as was stressed at the conference in the CPSU Central Committee on questions of accelerating scientific-technical progress, is to organize the mass production of the technology of new generations, capable of multiplying labor productivity and of opening the way for the automation of all stages of the production process. It is important to proceed to the delivery of equipment in complete sets and to

organize the in-house repair and servicing of equipment on a broad scale. Accelerated development is required in microelectronics, computer technology and instrument building as well as in the entire information industry.

The intensification of the economy is also putting stricter demands on the efficiency of new technology and on scientific-technical progress as a whole. The new technology must not only provide for an increase--and a pronounced increase at that--in the productivity of live labor. An indispensable demand on it under present-day conditions is a reduction of its cost per unit of capacity, productivity or other useful effect. It is thereby called upon to provide for a real savings of material and fuel-energy resources per unit of produced output. Only in this case it is possible to obtain--along with an increase in labor productivity--an increase in the return on investment and a reduction in material consumption, that is, go the way of the integrated and comprehensive intensification of production.

The acceleration of scientific-technical progress requires serious changes in the structure of public production and the distribution of resources and a further increase in the science-content of production. We can get some idea of this process on the basis of an analysis of the percentage of scientists in the total number of workers and employees (0.86 percent in 1965, 1.03 in 1970, 1.20 in 1975, 1.22 in 1980 and 1.24 percent in 1983) and of expenditures on science as a percentage of national income (3.6 percent in 1965, 4.1 in 1970, 4.8 in 1975, 4.9 in 1980 and 4.8 percent in 1983).

The data presented must not, of course, be considered absolute. To a large extent, they reflect extensive processes, at the same time that the main thing is the intensification of the impact of science on the development of public production. Also, not all of the ways to increase the science-content of production have been considered here, especially the embodiment of scientific ideas in new technology. In addition, expenditures for education, training and raising the skills of personnel also apply here. In this connection, it can hardly be considered justified that at the same time that there was an overall increase in expenditures for education (14.1 billion rubles in 1965, 19.8 billion in 1970, 26.2 billion in 1975, 31.1 billion in 1980 and 33.9 billion rubles in 1983), their percentage of national income has a steadily declining trend (7.4 percent in 1965, 6.9 in 1970, 7.2 in 1975, 6.8 in 1980 and 6.3 percent in 1983).

The high rates of scientific-technical progress are putting growing demands on the quality of manpower and they are making necessary more frequent additional training and sometimes retraining. Hence the necessity for a serious qualitative improvement of the entire education system. The reform of the secondary schools that has now been initiated is part of this large, complex and important work. Today questions relating to the improvement of the training of engineers and with enhancing the authority and social prestige of engineering work merit special attention.

The acceleration of scientific-technical progress and the intensification of the economy are unthinkable without sufficiently profound transformations in the social organization of production. Here many serious issues have arisen that need to be resolved. The use of the reserves available in this area will

permit a significant acceleration of the increase in labor productivity. It is primarily a matter of a significant enhancement of specialization and, on this basis, of raising the level of production concentration. For new technology can give good results and realize the possibilities invested in it only in well-adjusted and highly specialized production.

In reality, the level of specialization and thus of production concentration accomplished is not great. Its development is being hindered by bureaucratic barriers and the unreliability of economic ties. This latter circumstance causes the formation of vast above-standard reserves and immobilizes resources. The practice of self-supply and the establishment of a so-called noncommodity economy have become widespread. The improvement of the system of economic ties and the enhancement of their reliability are an important and indispensable condition for the improvement of the social organization of labor and the raising of the efficiency of the national economy.

The available data on the sizes of enterprises according to the number of workers, the amount of fixed capital and the volume of produced output do not reflect the true level of production concentration. Even at large enterprises issuing a large number of products, its real level, taking into account data on the production of similar output, may turn out to be low. At the present time, along with the development of specialization at active enterprises, it is expedient to establish relatively small but highly specialized enterprises producing homogeneous goods.

There are also significant reserves for improving the organization of production at the microlevel within the framework of production enterprises and associations. They are linked both to the possibilities for specialization within production as well as to the necessity for a serious improvement in the organization of the preparation of production, which is especially important in the case of retooling. As practice indicates, preparation of production that is well thought out and well planned makes it possible to multiply the effect from technical innovations and, conversely, its absence and underestimation make it much harder to obtain the desired effect from new technology.

Under the conditions of the acceleration of scientific-technical progress and intensification, economic growth is accompanied by serious changes in the structure of public production, especially in industry. A largely new relationship different from that of the preceding stage is developing between group "A" and group "B", between the production of the means and the subjects of labor, as reflected in Table 1.

The orientation towards the rapid renewal of production equipment requires an accelerated and overtaking increase in the production of the means of labor. This is doubtless an objective characteristic of the intensive type of expanded reproduction. One cannot, however, say this about group "A" as a whole, in which more than four-fifths of the entire produced output is subjects of labor. Their production must increase at a significantly slower rate than industrial output as a whole, which is a condition for the reduction of the materials intensity of public production.<sup>1</sup> This is confirmed by specific data on the development of large industrial sectors. (Table 2).

Table 1. Rates of Increase of Industrial Output (1970 = 100)

| Category  | 1975 | 1980 | 1983 |
|---|------|------|------|
| Production of the means of production (group "A") . . . | 146  | 183  | 202  |
| Means of labor . . . . .                                | 161  | 233  | 272  |
| Subjects of labor . . . . .                             | 142  | 172  | 187  |
| Production of consumer goods (group "B") . . . . .      | 137  | 165  | 185  |

Table 2. Rates of Increase of Industrial Output by Sector (1970 = 100)

| Sector  | 1975 | 1980 | 1983 |
|---|------|------|------|
| Industry as a whole . . . . .                   | 143  | 178  | 193  |
| The industrial sectors:                         |      |      |      |
| Electric power . . . . .                        | 141  | 180  | 195  |
| Fuel . . . . .                                  | 133  | 154  | 162  |
| Ferrous metallurgy . . . . .                    | 128  | 141  | 149  |
| Chemical and petrochemical . . . . .            | 165  | 218  | 251  |
| Machine building . . . . .                      | 177  | 268  | 317  |
| Timber, wood processing, and pulp and paper . . | 129  | 139  | 154  |
| Building materials . . . . .                    | 142  | 156  | 170  |

As the data indicate, electric power developed at rates close to the indicators for industry as a whole. Machine building--a principal maker of the means of labor--and the chemical and petrochemical industry developed significantly faster. In regard to sectors mainly producing subjects of labor (fuel industry, ferrous metallurgy, building materials industry, and the timber, wood processing and pulp and paper industry), they developed significantly more slowly than industry as a whole.

There is reason to believe that, taking into account the course of intensifying production and accelerating scientific-technical progress, the changes in the structure of economic growth will be characterized as follows:

--There will be an increase in the rate of development of machine building, which plays a decisive role in the reequipment of the national economy. As everyone knows, the rate of increase is to be increased by a factor of 1.5 to 2.

--The rates of development of sectors producing the subjects of labor will be relatively low (with the exception of the chemical and petrochemical industries). The main emphasis here will be on increasing the quality of output and on a more intense processing of raw materials and more consistent implementation of a policy of saving resources.

--Considering these two processes as well as the importance of the subjects of labor in group "A", it appears realistic to provide for a more rapid increase in the production of consumer goods over a rather long period, that is, for an increase in the output of the industry of group "B".

As a rule, global changes in the structure of public production are continuous. On the whole, however, economic growth under the conditions of intensification is characterized by an increasing dynamism of production and a highly mobile internal structure. This is due to both the nature of contemporary scientific-technical progress and rapid changes in the makeup of public needs (production and personal needs).

The changing conditions of economic growth also require the pursuit of an active structural policy, the timely selection of priority fields, and greater flexibility in the organization of production. There is also a serious increase in the demands on planning.

One of the most complex problems is that of combining the stability and flexibility of the tasks of the five-year plan, which is dictated to an equal degree by the current stage of scientific-technical progress. Practice has shown that the annual reconfirmation of planned tasks and the lack of long-term economic standards do not permit effective control of the intensification process, retard the development of the specialization of production, and have a negative impact on technical reequipment. To resolve these problems, associations and enterprises must have a clear perspective of their own work for a minimum of 5 years in advance.

At the same time, the emergence of new scientific ideas and technical solutions and the change in public needs--if their satisfaction is not postponed artificially--increase the necessity of a flexible reorganization of production and are incompatible with the rigidity of planned tasks. The forms of planning that have developed to date, the system of indicators used in it, and the criteria for the evaluation of the results of economic activity have turned out to be incapable of resolving this contradiction.

This is a very complex matter. Here there are no pat answers. One can merely state some general considerations about the direction in which the restructuring of the forms and methods of planning should be carried out. It is above all essential to attain a full and real balance in the plans. This is more important today than at any time in the past. Only in this case can there be a serious acceleration of scientific-technical progress, a pronounced increase in production efficiency, and a combination of the stability of planned tasks with the flexible restructuring of production.

In so doing, of course, substantial changes must be made in the nature of the plan as well as in its composition and in the selection of the indicators used in it. The more detailed it is, the more it is subject to all manner of changes. One cannot, for example, describe in detail the products list and keep similar tasks unchanged during a period of 5 years. Such an approach curbs scientific-technical progress. The specific products lists can be successfully determined on the basis of economic contracts between supplier enterprises and consumer enterprises.

Significantly more stability is being exhibited by economic standards called upon to take an increasingly important place in planning and thus to convert the five-year plan into the basis of cost accounting. As was emphasized at the conference in the CPSU Central Committee on questions in the acceleration

of scientific-technical progress, one must actually shift associations and enterprises to full cost accounting, sharply reduce the number of centrally established planned tasks, and see to it that their work is regulated to an increasing extent by economic standards.

It should be stressed that this does not abolish centralized planning and does not diminish its role. Such a reorganization changes--indeed, seriously changes--the forms and methods of planning work and makes them conform to the characteristics of economic growth under the conditions of intensification and scientific-technical progress. This is entirely natural and proper. No form of organizing planning work and no system of indicators used in planning can be permanent and immutable. Each new stage in the development of the socialist economy puts its own demands on them.

The generality and immutability of principles and the mobility of forms are what characterize the contemporary approach to the improvement of planning and management and the entire economic mechanism.

An active structural policy and the selection of the priority directions of development are not the antipode of balance. By no means does the need for serious and radical shifts in the structure of public production arise every year. In addition, with the high level of prognostic work, they can be forecast in advance. By virtue of this, precisely plans, both the five-year plan and long-term plans, appear as the main instrument of structural policy.

The selection of the priority directions for development must also be carried out not before the plan is collated and confirmed but in the process of its elaboration. The correct setting of priorities makes it possible to pick out the most effective solutions and to give preferential development to sectors, production systems and economic regions upon whose work the intensification of the economy depends to a crucial extent. This is the basis for deciding what is included in the plan and in what amount. And it should include something only in the amount that can be achieved with the available resources. Under this approach, no conflict can arise between balance and the establishment of economic and socially significant priorities.

Finally, there remains a certain gray area, which will always exist in a dynamically developing economy. To resolve the problems arising in a given area, it is essential to have a ramified system of planned reserves at various levels of management. The establishment of a system of reserve funds including the reserves of production capacities is an important and necessary condition for a rapid and flexible reaction to the appearance of new scientific-technical solutions and to a change in public needs.

One frequently hears the objection that the establishment of reserves will inevitably lead to a reduction in the rate of economic growth and that it is therefore hardly justified. Yes, a slowing of the economic dynamics can indeed occur but only when the problem of growth is reduced to that of increasing exceptionally gross volume indicators.

At the same time, there is no doubt that a reliable system of reserves will make it possible to accelerate the introduction and assimilation of new

technology and will contribute to the rapid renewal of goods produced, to an increase in its quality, and to fuller and prompter satisfaction of newly arising needs. And all of this is of decisive importance for the evaluation of the quality of economic growth in the current stage.

The comprehensive development and consolidation of the production infrastructure of the national economy is an important condition for the high dynamism and flexibility of production while simultaneously ensuring that it is balanced. Insufficient attention to it in the past and the limitation of funds for its development are among the main reasons for the difficulties and bottlenecks arising in the economy. It has now become necessary to develop and implement a well-considered long-term program of measures aimed at the establishment of a ramified production infrastructure meeting the needs of economic growth under the conditions of intensification and scientific-technical progress.

The question of the evaluation of the final results of economic growth merits special attention. In the period of the establishment and formation of the highly developed large-scale national economy complex, economic growth (to a certain degree and with certain reservations) has itself emerged as a final result. The rates of growth of industrial output and the volume of the freight turnover, the amounts of cast iron and steel smelted and of coal and oil extracted, and the production of machine tools, tractors and automobiles gave a reliable and completely satisfactory idea of the successes in the development of the national economy.

Under the conditions of a highly developed economy, the role of final results is increasingly that of resolving social tasks that have always been of great importance. But they appeared as a consequence of economic growth and not a basic specific aim, point of reference and criterion in the evaluation of its final results.

The putting of social goals and tasks in the forefront is linked not only to the increase in the scale of public production. Here the increased maturity of socialist society and of the entire system of its production relations comes through clearly and strongly. And the more advanced our society is and the greater the maturity of its economic relations, the more fully and consistently its historical advantages and predestination are revealed and the more latitude there is for the action of its inherent laws, above all the basic economic law of socialism. Precisely by virtue of the new level of development of productive forces and the greater maturity of production relations, the final result of economic growth is now seen as the fuller satisfaction of the material and spiritual needs of the Soviet people and in the establishment of better conditions for the all-round development of each member of society.

In the final analysis, scientific-technical progress and the entire multiple-plan work in the intensification of public production are subject to the fulfillment of these social tasks. The achievement of the assigned social parameters with a smaller volume of output is an indicator of the efficient management of the economy and of a consistent orientation toward intensive growth. If the overall indicators of the volume of output are higher with the same final results, then this is not a good thing but misfortune, evidence of low production efficiency.

To a considerable degree, the success of the work to improve the economic mechanism and to ensure that it measures up to the requirements of the comprehensive and purposeful intensification of the economy depends upon a correct understanding of the characteristics of economic growth in the current stage.

#### FOOTNOTE

1. Here the author digresses from the problem of foreign economic ties, which, at their present scale and with their growing impact on the process of expanded reproduction, can have a substantial influence on the structure of production and on the rates of growth of different sectors. But there is reason to believe that in foreign economic relations as well, above all in exports, an analogous process will take place, that of the acceleration of the rate of growth in the export of machine building output and a slowing of the rates for the export of goods in the raw materials group.

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## INVESTMENT, PRICES, BUDGET AND FINANCE

### YIELD ON CAPITAL IN UZBEK INDUSTRY DISCUSSED

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[Article by B. Li, sector chief of the NIEI under the UzSSR Gosplan, candidate of economic sciences: "Dynamics of Change in Output-Capital Ratio in the Republic's Industry"]

[Text] When determining the dynamics of the change in the output-capital ratio in the republic's industry it becomes especially important to evaluate the effectiveness and reveal the degree of utilization of the already creative production potential and the national wealth, which largely determines the efficiency factor of public production. But when characterizing fixed production capital and capital investments related to it as constituent parts of the production potential one should take into account the increased proportionality of the development of the economy, the high rates of growth and the constant rise in the technical level of fixed capital and production capacity as well as the improvement of interbranch and territorial proportions. (During 1971-1983 the republic put into operation 58 billion rubles' worth of fixed capital, including 35.4 billion rubles' worth of production capital. Industry accounts for more than 26.5 percent of the capital investments and the produced national income, and also about 24 percent of the functioning fixed production capital.

Since an increase in the output-capital ratio is directly related to a reduction of the production cost of products, which is achieved both as a result of reducing overhead expenditures by increasing the production volume per unit of time and reducing the amount of amortization per unit of output, deterioration of the utilization of fixed industrial production capital is an accurate symptom of its situation. Thus in 1980 in the republic's industry the aforementioned indicator (fixed industrial production capital) amounted to 86 percent of the 1975 level, and in 1983--74.6 percent. (This tendency is also formed with dominant growth of fixed capital). For the most part a reduction in the effectiveness of fixed production capital is observed in branches of group B, particularly in the food industry and light industry. Since these branches produce more than 56.4 percent of the entire gross output produced by the republic's industry and their output-capital ratio is higher than average (in light industry--3.7 times and in the food industry--3 times), their dynamics are reflected a great deal in the effectiveness of the utilization of capital in industry as a whole.

The output-capital ratio is a synthetic indicator and its level depends on the influence of many factors, of which a decisive role is played by technical progress and economizing on live and embodied labor. The indicator of the output-capital ratio in industry as a whole is an average weighted amount of branch indicators and therefore the level and dynamics of the consolidated indicator of the utilization of fixed production capital in industry is determined both on the basis of changes in the branch structure of fixed capital and the level of output-capital ratio in the branches of industry.

A quantitative evaluation of the influence of changes in the branch structure and the levels of utilization of fixed capital in the branches on the dynamics of the consolidated indicator of the output-capital ratio in industry can be obtained with the help of the index method, which will make it possible to establish the degree of influence of changes in the proportion and level of the indicator of the output-capital ratio of each branch on the level in industry as a whole.

The totality of factors includes influencing the dynamics of the output-capital ratio can be divided (with a certain amount of conventionality) into two groups: factors related to the nature of the utilization of the production apparatus and factors related to the process of reproduction of fixed capital.

As analysis shows, increasing the capital availability for labor does not provide for a proportional increase in its productivity. As a result, for each percentage point of increase in the capital availability for labor in industry in the republic in 1980 there was on the average 0.85 percent increase in productivity, and in 1983--only 0.76 percent. Because of the negative tendency of the output-capital ratio the relative overexpenditure on fixed production capital during the period of 1976-1983 was more than 7 billion rubles.

Under the 10th Five-Year Plan, as a result of increased labor productivity the increase in national income amounted to 3 billion rubles. At the same time, as a result of the reduction of the level of output-capital ratio, we failed to receive 1.8 billion rubles' worth of national income. This kind of movement of indicators of the output-capital ratio is becoming increasingly difficult to compensate for through the effectiveness of other factors in production.

It should be noted that the volume of industrial output depends, on the one hand, on a change in the branch structure of fixed production capital and, on the other, on a change in the level of output-capital ratio. Under the 10th Five-Year Plan the absolute increase in gross output in the republic's industry amounted to a total of 4.2 billion rubles. Beginning in 1971 through 1983 it was provided solely as a result of extensive factors. That is, as a result of increasing fixed production capital. Calculations show that changes in the dynamics of the output-capital ratio taking place under the preceding five-year plan, on the one hand, contributed to its reduction. During this time it decreased by 14 percent. And changes in branch levels, which dropped

by 21 percent, exerted a large influence on this. On the other hand, as a result of structural improvements, it increased by 8 percent.

The material composition and the element and age structure of fixed production capital also exert an influence on the level of output-capital ratio. The tendencies here consist in the following:

the proportion of buildings in the overall fixed production capital have a tendency to decrease;

the proportion of other structures and means of transmission is regularly increasing because of the increased share of the extraction branches and electric energy in the overall value of fixed production capital;

the proportion of machines and equipment is decreasing somewhat.

Such changes in the structure of fixed production capital are brought about by advances made in the branch structure of industry and the increased value index for construction and installation work.

A progressive tendency in the change in the structure of fixed production capital in UzSSR industry is the tendency toward an increased proportion of the chemical and petrochemical industries, machine building and mental processing, and branches that determine technical progress. But then there is a reduction of the proportion of fixed capital on light industry and the food industry, which to a significant degree determine the republic's production specialization, the comprehensive development of its economy and the level of industrial development of the national economy.

In order to increase the output-capital ratio in the structure of fixed capital it would be desirable to increase the proportion of power machines and equipment while constantly decreasing the proportion of buildings, structures and means of transportation. The ratio between the active and passive parts of fixed capital is a product of the economic policy in the area of capital investments and the organization of capital construction and methods of management. The more significant the proportion of the active part in the overall value of fixed capital, the higher the level of output-capital ratio. With respect to the republic's industry, an increase in the proportion of the active part of fixed capital by 1 percent can increase the output-capital ratio by 0.3-0.35 percent, which will increase the output of products by 65.9 million rubles.

A large reserve for increasing the return from fixed capital is to reduce the quantity of worn-out and obsolete equipment. A high level of worn-out equipment not only reduces the possibilities of producing new products, but also causes real economic harm through above-normative down time and expenditures on repair. A study of the age composition of mechanized flow lines and automated lines in the republic's industry showed that 47.5 percent of the mechanized flow lines and 21.9 percent of the automated lines have been in operation for more than 10 years, which shows their imperfection and the need for technical reequipment.

The proportion of resources allotted to replace worn-out and outdated equipment is very small. It provides for annually replacing 1.8 percent of the equipment in industry. Therefore the introduction of new fixed capital and production capacities is still being carried out while continuing to operate obsolete and worn-out implements and means of labor.

But one should not forget that raising the technical level of existing production will take place primarily as a result of prompt removal of outdated fixed capital, the introduction of new fixed capital and its effective utilization. Thus in the extraction industry recently we have begun to see a reduction in the effectiveness of the utilization of fixed capital. The reasons can be included among objective factors. At the same time there are a multitude of subjective factors which are conditioned by shortcomings in the areas of planning, management and incentives. The most important of these are incomplete utilization of production capacities, prolongation of the time periods for the construction of facilities, the release of these facilities with unfinished work which impedes the assimilation of the production capacities, inadequate qualifications of personnel, interruptions in the supply of raw and other processed materials, and other factors.

At the present time in the republic's industry the coefficient of updating fixed production capital amounts to 7.8 percent, including for building and structures--6.7 percent, and machines and equipment--9.8 percent. An evaluation of the level of application of production capacities, according to figures for 1984, shows that the situation from this standpoint is the least favorable in the production of refrigerators (29.6 percent), wood materials (36.9 percent), caprolactam (55.3 percent), keramzit (56.8 percent) and electric engines (60 percent). At the same time, complete utilization of existing production capacities on the scale of 1984 would make it possible to obtain an additional 869 million rubles' worth of products.

An analysis of the reasons for this situation shows that about 46.6 percent of the products which were not obtained were not produced because of poor material and technical supply, incomplete intraproduction, intrabranch and interbranch coordination, and inadequate balance in individual stages and within the unified production process; 16.3 percent--because of the unsatisfactory condition of the technological equipment; more than 5 percent--because of the lack of sales and limited demand; and about 32 percent--because of the poor qualifications of the workers and the shortage of labor force.

The causes of the existing situation are explained to a large degree also by the insufficiently high degree of utilization of technical innovations in terms of time and capacities. In particular, in the republic's industry, according to a selective investigation conducted by the UzSSR Central Statistical Administration in 1983, almost one-fourth of all the mechanized flow lines that were examined and one-third of all the automated lines were operating on one (and less) shift and only 28 percent of the mechanized flow lines and 18.1 percent of the automated lines were operating on two shifts, which shows the existence of considerable reserves for increasing the return from funds invested in the formation of the active part of fixed capital on a new technical basis as a result of increasing the degree of intensiveness of their utilization.

Many shortcomings in the utilization of production capacities which explain the dynamics of the output-capital ratio, such as incomplete construction work, defects in equipment and lack of coordination in terms of capacities or resources, go back to the investment and production process of fixed production capital. An efficient and focused investment policy should suggest the determination of the sources of the formation of capital investments (through the national income and the reimbursement fund, centralized and noncentralized); the areas for the expenditure of capital investments (on intensification of existing fixed production capital or on expansion of the production apparatus); and the branch, technological, reproduction and territorial structure of capital investments.

It is necessary (and this is very important and immediate) to consider problems of expanding the scale and increasing the reconstruction of industrial enterprises, updating and replacing outdated fixed production capital and reducing the duration of the investment cycle.

Reconstruction also largely determines the rates of updating existing fixed capital. Increasing the effectiveness of the production potential requires a significant rise in the technical level of production both as a result of prompt elimination and replacement of outdated fixed capital and through introducing capacities which are based on the latest achievements of scientific and technical progress.

A change in the cost of construction and installation work, the level of wholesale prices for machines and equipment, and the cost of repair work--all this leaves its mark on the cost of reproduction of a unit of production capacity and frequently violates the correct ratio between the productivity of equipment and its cost.

Indicators of the production of products and the sums of fixed production capital are subject to the influence of prices, and therefore in analytical work one should use price indexes and means of eliminating the influence of prices.

The problem of the output-capital ratio is related to the entire system of planning, accounting, analysis and evaluation of the results of the activity of the enterprises, associations and branches of material production. It is clear that its dynamics should be controlled. But the position of the output-capital ratio should be more active. How?

First and foremost, the output-capital ratio should be planned at all levels of management of the national economy. It should be an important indicator in current and long-range plans of the ministries, enterprises and associations,

and the results of their work should be evaluated in terms of this indicator along with others. This will increase its role in the work of all branches of the national economy and will provide for improvement of the qualitative indicators of their work.

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ECONOMIC MODELING AND COMPUTER TECHNOLOGY APPLICATION

MODELING OF CAPITAL INVESTMENT FORECASTS DETAILED

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[Article by V. K. Faltzman, A. Yu. Ozhegov, G. B. Sychev and V. N. Borisov (Moscow): "On Comprehensive Prognostication of the Structure of Capital Investments"]

[Text] 1. Formulation of the Problem and Description of the Model

When developing medium-term and long-term national economic predictions a great deal of attention is devoted to problems of the structural policy in the area of capital investments. Here the objects of prediction are: a) the branch and interbranch structure of capital investments, which show the interbranch and functional distribution of investments; b) their reproduction structure, which reflects the ratio between expenditures on technical reequipment, reconstruction, expansion, new construction, maintenance of capacities and also the acquisition of equipment which is not included in the estimates for the construction sites; c) the technological structure, which is characterized by the proportion of equipment and construction and installation work (SMR) in the capital investments; d) the physical-substantial structure of capital investments which reflects the proportion in them of individual kinds of equipment and also the SMR. Since the main achievements of science and technology are materialized in new implements of labor, the prediction of the physical-substantial structure of investment deliveries and the production of equipment are especially important. Thus the structure of capital investments in its entirety encompasses the distribution of all the main kinds of investment resources--investments themselves, equipment and SMR.

The goal of comprehensive prognostication of the structure of capital investments is to reflect in national economic predictions the possibilities, variants and ways of providing resources for the intensification of the development of the economy.

As experience shows, the structure of capital investments is one of the main parameters that control economic growth. Indeed, in the modern stage intensification of the development of the economy is characterized, on the one hand, by increased possibilities of scientific and technical progress and the demand for new technical equipment and, on the other, under the influence of a number of factors (rates of economic growth, norm for accumulation, resources of products of machine building and construction, the provision of metal and so

forth), it is accompanied by moderate and even slowing rates of increase in the volumes of capital investments and other investment resources. Under these conditions the center of gravity of the investment policy shifts from increasing volumes to improving structures of capital investments.

Capital investments, especially equipment, materialize the main achievements of science and technology and act as a leading factor and the main limitation of the process of investments in the economy. Under the conditions of the gradual exhaustion of the supplies of natural resources on the territory of the European part of the USSR and the reduced growth rate of labor resources, investment resources are becoming a most important parameter for controlling economic growth, which is most easily subject to purposive influence and regulation on the part of society.

Fig. 1 gives a diagram of a comprehensive prediction of the structure of capital investments in the form in which it is being utilized at the present time in the TsEMI for long-term substantiations of the prospects for economic development.

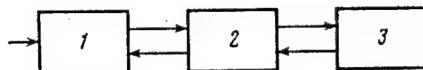


Fig. 1. Block diagram of Comprehensive Prediction of Structure of Capital Investments: 1--block of reproduction and technological structure of capital investments; 2--block of physical-substantial structure of capital investments; 3--block of physical-substantial structure of machine-building products.

The realization of this diagram in comprehensively integrated form was preceded by the development of methods for constructing its individual blocks. In particular, in order to predict the growth rates and branch structure of capital investments, various variants were suggested for a dynamic model of the interbranch balance (1, 2). The methods and results of the development of predictions of the reproduction and technological structures are described in (3, 4), the growth rates and the physical-substantial structure of investment deliveries of equipment--in (5, 6), and the growth rates and structure of the production of equipment--in (7).

The block diagram (Fig. 1) presupposes the integration of these modules into a unified comprehensive calculation. Then the models of the interbranch balance (distribution of capital investments among the branches) are subjected to additional structuring: for investments they calculate the reproduction, technological and physical-substantial structure in interconnection with the structure of the production of equipment.

The model used for comprehensive prognostication of the structure of capital investments is a system of balance and regression equations. These equations are given in (3, 5-7). Without reproducing these, we shall indicate the following peculiarities of the model.

1. In the model scientific and technical progress is given exogenously. For input information they use the evaluation of partial indicators of the effectiveness which are contained in branch predictions, data from processing title lists, autonomous predictions of investment matrices, predictions of the change in the structure of technological means of production of the most important kinds of products, and so forth.
2. The time frame is 10-20 years. It is determined by the nature of the exogenous information: the lower limit corresponds approximately to the maximum degree of relation of capital investments to the existing construction reserves, which are reflected in the title lists, and the upper limit--the time periods adopted in the USSR for the development of long-term scientific and technical and socioeconomic prognoses.
3. The model encompasses a complex system of indicators and is distinguished by its great dimensionality. For each predicted year the following matrices are calculated: the technological structure of capital investments with dimensions of the figures 18 x 6; for their physical-substantial structure--in the cross-section of 18 branches and from 40 to 90 positions on the list of equipment which are singled out in the calculation. The predictions of the growth rates and structure of the production of the equipment are done for 11 branches of machine building, singling out certain kinds of equipment.
4. In the model the balance ties prevail over the econometric ones, which is more convenient for long-term predictions. The econometric dependencies are used only when the existing information and (or) the high degree of complexity of the interconnection of the indicators make it impossible to use dependencies of the balance type.

The existence of reverse connections between the indicators of the model makes it necessary to use integration methods and diagrams of calculations, and it also opens up additional possibilities of utilizing the model not only for automation of planned calculations, but also as an imitation model. The model makes it possible to imitate the process of supplying investment resources for large-scale changes in the structural, investment and technical policy. For example, it can be used to take into account the limitations from common volumes of capital investments and the possibility of providing the corresponding equipment on: the acceleration of the removal and replacement of obsolete and worn-out fixed capital in the processing branches of industry; the structural improvements in the technological means of the production of products (change in the ratios for the output of electric energy at AES's, TES's and GES's; the open-pit and underground methods of mining coal (marten, oxygen converter and electric steel-smelting methods of smelting steel and so forth); large changes in the proportions in the national economy, for example in the direction of more rapid development of the investment complex with a simultaneous unloading of the raw material branches, significant changes in the proportions between the extracting and processing industries, between industry and agriculture, and other hypothetical improvements.

The decisive role of investment resources in the national economy and the stage of its intensification makes it possible to utilize the model for forming variants of national economic dynamics. For example, with the growth

rates that are given for the future and the structure of the production of equipment, it can be used to calculate the future rates of economic growth or, conversely, with the given rates of economic growth of the national economy, in one of the forthcoming five-year plans one can determine the necessary growth rates and structure of production of equipment in the preceding five-year plans.<sup>1</sup> Here the advantage of the given arrangement as compared to the branch models for predicting the development of machine-building branches consists in the possibilities of measuring the final national economic results of investment activity.

The existing experience in the utilization of the model in macroeconomic predictions up to this point includes the calculation of variants which are distinguished from one another only in terms of the volume and branch structure of capital investments. In the future it would be expedient to expand the analytical possibilities of the model to the investigation of various types of scientific and technical progress--energy-, labor-, metal-, fund- and resource-saving devices, and so forth. The model is intended not so much for predicting various future economic results or investment expenditures necessary for their achievement as it is for creating high-quality scenarios of the future technical and investment policy. Therefore along with the actual variants it is expedient to evaluate the maximum variants, whose realization is not very probable. Below we are presenting methods of predicting the structure of capital investments for individual blocks of the model.

## 2. The Block of the Reproduction and Technological Structure of Capital Investments

The prediction of the reproduction structure of capital investments is intended for controlling the process of updating fixed capital. The control is carried out through changing the proportions in the distribution of funds between new construction, reconstruction and other forms of reproduction. The prognosis is based on the growth rates and branch structure of capital investments calculated for the future with the help of the dynamic model of inter-branch interactions. The block diagram of the prediction is given in Fig. 2.

The indicators of the reproduction of fixed capital reflect the ratios among individual elements of their balance. If we put to the side the transfers and incomes that do not involve profit, that is, the secondary processes of redistribution, the reproduction of fixed capital is determined by a recurrent balance equation  $F_t = F_{t-1} + V_t - W_t$ , where  $F_t$  and  $F_{t-1}$ --the funds at the end of the years  $t$  and  $t-1$ , respectively;  $V_t$ --the startup of capital;  $W_t$ --its removal during the year  $t$ . The startup of capital can be pictured as a function of capital investments  $I_t$ , namely  $V_t = \gamma_t I_t$ , where  $\gamma_t$ --the ratio between the introduction of capital and capital investments in the current period, which depends on the change in the residuals of incomplete construction and the proportion of nonfund-forming capital investments.

In order to predict the process of updating fixed capital one usually uses the indicators: the coefficient of removal  $k_t^W = W_t/F_{t-1}$ , the coefficient of updating  $k_t^V = V_t/F_t$ , and the coefficient of intensive updating  $k_t^I = W_t/I_t$ .

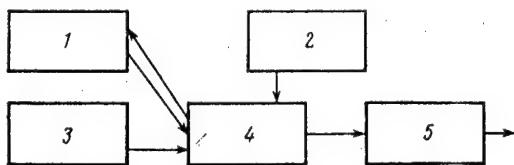


Fig. 2. Block diagram of prediction of reproduction and technological structure of capital investments: 1--indicators of reproduction of fixed capital; 2--possible reproduction structure of capital investments; 3--growth rates and branch structure of capital investments; 4--required reproduction structure of capital investments; 5--technological structure of capital investments.

The coefficient of withdrawal  $k_t^w$  is related to the coefficient of intensive updating  $k_t^I$  and the growth rates of capital investments  $r_t = I_t/I_{t-1}$  with a directly proportional dependency

$$k_t^w = \frac{k_{t-1}^w}{k_{t-1}^I (1 - k_{t-1}^w) + k_{t-1}^w} k_t^I r_t$$

The prediction of the indicator  $k_t^v$ ,  $k_t^w$  and  $k_t^I$  is done for each of the 18 branches on the basis of an analysis of branch predictions of the level of obsolescence and wear and tear, and the surface life of the fixed capital; the socioeconomic motives for updating the production apparatus in individual branches and their priorities; the existing limitations on the accumulation of fixed capital, including because of the possibilities of providing additional labor resources for the new jobs; and the possibilities and expediency of increasing the reliability and durability of equipment.

The indicators of the reproduction of fixed capital in industry and the national economy as a whole are determined through grouping the corresponding branch data. The need for predicting the indicators of reproduction of fixed capital at the macrolevel on the basis of branch predictions is brought about not only by the quantitative differences in their amounts for individual branches, but also by the different requirements for their future dynamics: while in a number of processing branches of industry it is necessary to have accelerated removal and replacement of outdated fixed capital, in agriculture and the extraction branches one should proceed toward increasing their service lives.

On the basis of an autonomous prediction of the indicators of reproduction of fixed capital, one establishes their normative values which are introduced as initial data into the calculation of the reproduction structure of capital investments.

The balance of fixed capital, like the indicators for updating it, is not planned for the future. Therefore in order to control the process of updating fixed capital using planning instruments, it is necessary to change over to indicators of the reproduction structure of capital investments, which are control parameters of the investment policy. We predicted the reproduction structure within the framework of those consolidated groups of reproduction forms in which the first includes mainly intensive forms (reconstruction, technical reequipment, maintenance of capacities); the second--mainly extensive forms of reproduction (expansion and new construction); and the third--other forms (equipment not included in the estimates for the construction site, planning and research work). The indicators of the reproduction structure of capital investments for branch  $i$  were determined as  $d_{in}^I = I_{in}^I / I_i^I$ , where  $n$ --the reproduction group of capital investments ( $n = 1, 2, 3$ );  $I_i^I$ --the overall volume of capital investments in the branch.

In order to changeover from predicting the intensiveness of the reproduction of fixed capital ( $k_i^I$ ) to indicators of the reproduction structure ( $k_{in}^I$ ) we use the coefficient of intensive updating for the various groups of reproduction forms ( $k_{in}^I$ ). Since the balance of fixed capital is not developed for the various forms of reproduction, there are no statistics for this indicator. We suggested a method of evaluating the indicator  $k_{in}^I$  which is based on the construction and utilization of data of combined balances of fixed capital and capital investments, including for the active part of them, information on the removal of individual kinds of equipment in the various branches, and also data from the balances of capacities. This made it possible to determine the value of  $k_{in}^I$  for the period of 1976-1980. In industry it amounted to: for the group of reconstruction and technical reequipment--in  $k_1^I = 0.35$ ; for the group of new construction and expansion-- $k_2^I = 0.05$ ; and for the group of other factors-- $k_3^I = 0.40$ . Close to these were the evaluations of the coefficients for the overall volume of production capital investments (4).

At the basis of the prediction of the indicators  $k_{in}^I$  for the future should be: an analysis of the planning estimates for individual forms of reproduction of fixed capital; branch calculations of a possible increase in the proportion of expenditures on making up for withdrawals in capital investments for construction and technical reequipment of existing enterprises (taking into account: overestimation of funds and elimination of the disparity between the value of the equipment that is being replaced and that replacing it; changes in the nature of reconstruction and technical reequipment and stimulation and more strict control over the replacement of fixed capital; long-range balances of production capacities which contain data concerning proposed removal of it (this amount conditions  $k_{12}^I$ ).

From the definition of reconstruction, technical reequipment and other reproduction areas of capital investments it follows that in all cases  $k_{11}^I$  is equal to or greater than  $k_{12}^I$ . Therefore the policy for accelerated removal and replacement of worn-out fixed capital presupposes purposive increase in the proportion of capital investments for reconstruction and technical reequipment ( $d_{11}$ ) as a result of reduction of the proportion of expenditures on new construction and expansion ( $d_{12}$ ). A slowing up of the removal and replacement of fixed capital, which can be achieved within individual branches

as a result of increasing the reliability and improving the conditions for operating mobile technical equipment, is reflected first and foremost in the reduction of  $k_{i3}^I$  and does not presuppose a mandatory change in the reproduction structure of capital investments.

A prediction of the indicators of the reproduction structure of capital investments establishes proportions in their distribution between reconstruction and technical reequipment of existing capacities ( $d_{i1}$ ), on the one hand, and new construction and expansion of enterprises ( $d_{i2}$ ), on the other. The amount  $d_{i3}$  is applied in a fixed amount for each period. These proportions are calculated on the basis of the normatively given value of indicator  $k_i^I$  with the help of the dependency

$$k_i^I = \sum_n d_{in} k_{in}^I, \quad \text{where} \quad \sum_n d_{in} = 1, \quad d_{i3} = \text{const.}$$

The prediction of the reproduction structure cannot proceed from the needs for intensification of the updating of fixed capital alone, but must take into account the limitations on the reduction of the proportion  $d_{i2}$  of new construction and expansion, and also the corresponding amount of the indicator  $d_{i1}$ . These limitations are related to the output of new products, the development of production in new regions and the dissemination of principally new technologies which could not be provided through reconstruction of existing production.<sup>2</sup> An autonomous prognosis which takes into account the limitations which have been considered makes it possible to determine the lower limit of  $d_{i2}^*$  for a reduction of the proportion of capital investments in the group of new construction ( $d_{i2}$  is less than or equal to  $d_{i2}^*$ ) and correspondingly the upper limit  $d_{i1}^*$  for the amount of the proportion of capital investments allotted for reconstruction and technical reequipment ( $d_{i1}$  is less than or equal to  $d_{i1}^*$ ).

In the event that the limitations are not maintained it is necessary to return to a revision of the autonomous prognosis of the indicators of reproduction of fixed capital  $k_i^I$ . Additionally, in the system of calculations there arise reverse connections (Fig. 2) which are directed toward coordinating two autonomous predictions. The reverse ties are realized in the form of a program of iterative calculations which provide for step-by-step elimination of contradictions in the autonomous predictions of the reproduction structure of fixed capital and capital investments. After these contradictions are removed it is possible to move on to the next stage in the calculation--prediction of the technological structure of capital investments. The predictions made with the help of this model showed that the policy for accelerated removal of fixed capital in the future cannot be limited simply to increasing the proportion of reconstruction and technical reequipment in the capital investments. Even with a maximum increase in their proportion, at best it would be possible merely to stabilize the amount  $k^W$  at the level that has been reached. In order to increase it further it is necessary to change the very nature of reconstruction and technical reequipment, increasing in them the expenditures to make up for equipment that has been removed (4).

This, in particular, places special requirements on the price, the technical level and the quality of the equipment that is produced. In keeping with the principles of capital savings, the technical level of machine-building products should correspond to the conditions for operation by a specific consumer; the parameters of a new machine must be not maximized, but optimized, taking into account the most complete utilization of its consumer qualities and a price reduction; machine builders should provide for stability of the quality of their products, not only in the exhibit models, but also in mass-produced products that go to the national economy.

The technical structure is measured by the proportion of capital investments used for the acquisition of equipment, instruments and inventory, for construction and installation work, for planning and research work, and other expenditures. Since the dynamics of the proportion of the last group are fairly stable, in the future it is possible to calculate them autonomously and to make them fixed. Then the task of predicting the technological structure will be reduced to determining the proportion of capital investments for the acquisition of equipment ( $q$ ).

The purpose of predicting the technological structure of capital investments is to provide for balance in the distribution of the load between the two capital-creating branches, machine building and construction. A change in the technological structure of capital investments, while determining the structural advances between the active and passive parts of fixed capital, acts as a factor in increasing or reducing the output-capital ratio. But the technological structure is not a controlled parameter, an active element in the investment policy. The proportion of equipment in capital investments of branch  $i$  is formed as

$$q_i = \sum_n d_{in} q_{in},$$

where  $d_{in}$  -- the indicator of the reproduction structure (proportion of the reproduction area  $n$  in capital investments);  $q_{in}$  -- the proportion of expenditures on the acquisition of equipment, instruments and inventory for each area  $n$  of the reproduction structure.

The proportion of expenditures on equipment in production capital investments for reconstruction and technical reequipment amounts to  $q_{i1} = 0.50$ , and for new construction and expansion-- $q_{i2} = 0.21$  (3). Therefore the policy of the priorities for reconstruction and technical reequipment means an increase in the load for the machine-building complex and a reduction of the load for the construction complex.

The amounts  $q_{in}$  are determined for the future with the help of autonomous branch predictions. But  $q_{in}$  is influenced by interbranch distribution of capital investments among individual technologies;<sup>3</sup> the proportion of imported equipment in the capital investments; accelerated mechanization and automation of production, whose implementation requires minimal expenditures on construction and installation work and is basically carried out through the purpose of

equipment; the ratio between the dynamics of the value of equipment and construction and installation work; the change in the volumes of incomplete construction, the proportion of equipment in which is very small (20-25 percent), and expenditures on construction and installation work comprise up to 80 percent (3).

The planning estimates can serve as a source of information for the amount of  $q_{in}$  for the next 5-7 years.

Predictions of the technological structure of capital investments made using this model make it possible to give a quantitative evaluation of those large redistributions in the load for machine building and construction which can arise with a changeover to a policy of intensification of the updating of fixed capital and to earmark for each stage of development the maximum loads on the capital-forming branches.

A prediction of the technological structure of capital investments determines the dynamics of the investment deliveries of equipment to the national economy, which will serve as initial information for the block of the physical-substantial structure of capital investments.

### 3. The Block of the Physical-Substantial Structure of Capital Investments

The purpose of the block is to establish the need for investment deliveries of the main kinds of equipment. The level of grouping of equipment in the model is conditioned by the number of positions of the subbranches of machine building accepted at the present time in the existing statistical reports for planning the volumes of production of machine-building products. This level corresponds to the existing object specialization and includes 35-40 names of equipment which, however, in a number of cases, does not make it possible to reflect fully enough the changes in the technologies of the branches. Therefore we have developed an additional model which includes approximately 90 positions for equipment.

The basis of the model for the physical-substantial structure of capital investments is composed of investment matrices of equipment of  $18 \times 40$  and  $18 \times 90$ . The column of the matrix is the physical-substantial structure of capital investments in equipment for the given consumer branch, and the horizontal line is the structure of the interbranch distribution of resources of the given type of equipment.

For each of these 18 branches we have selected only the most important kinds of equipment, which take up 60-80 percent of the capital investments in the branch. As a result, the matrix is not filled in by more than 20 percent.

For example, the matrix for investment deliveries of equipment for ferrous metallurgy includes the following kinds of it: earth-moving machines, sintering, coke, enriching, blast furnace and steel-smelting equipment, oxygen installations and installations for rare gases, forge and press machines (basic technological equipment for various areas of ferrous metallurgy), and also lifting and transportation equipment, rolling stock, trucks, instruments

for means of automation, computer equipment, transformers, converters, high-voltage equipment and electric welding equipment (for the production infrastructure of ferrous metallurgy).

Investment deliveries  $I_j$  of equipment of  $j$  kind in the national economy are

$$I_i = \sum_j I b_i q_i h_{ij} / (1 - \alpha_i).$$

In this expression the overall volume of production capital investments  $I$  and their branch structure ( $b_i = I_i / I$ , where  $I_i$ —capital investments in branch  $i$  are determined in the block of the dynamic balance of interbranch interactions.

The proportion of expenditure  $q_i$  on acquiring equipment is taken into account in the block of the reproduction and technological structure. The following amounts are obtained independently:  $h_{ij}$ —the proportion of equipment  $j$  in capital investments of branch  $i$ ;  $\alpha_j$ —the proportion of other branches which are not included in the calculation of the need for equipment  $j$  through the coefficients  $h_{ij}$ .

There are no data concerning deliveries of equipment in value terms in the report. Since the indicator  $h_{ij}$  and  $\alpha_j$  do not have a statistical analogue, the main difficulty in realizing the models consisted in preparing the block of data for these indicators.

For the report period the matrices  $h_{ij}$  and the vector  $\alpha_j$  were formed on the basis of performance balances and plans for the distribution of equipment of the USSR Central Statistical Administration and data from annual reports of machine-building ministries concerning the volumes of production of individual kinds of equipment in physical and value terms (forms Nos 6, 8 of the annual reports) and other sources of information.

The indicator  $h_{ij}$  is taken into account independently for a certain fixed reproduction structure of capital investments. Yet the experimental calculations showed that because of differences in the time periods for the service of individual kinds of equipment, the physical-substantial structure of the capital investments in new construction, expansion, technical reequipment and other forms of reproduction differ significantly. Therefore in the future it will be necessary to overcome the statistical difficulties in establishing the physical-substantial structure of capital investments in terms of their reproduction forms ( $h_{ijn}$ ) and change over to calculating investment matrices according to the model

$$I_j = \sum_i \sum_n I b_i d_{in} q_{in} h_{ijn} \frac{1}{1 - \alpha_j}.$$

The predicted matrices  $h_{ij}$  are determined with the help of: a) an analysis of the existing trends in structural changes in the deliveries of equipment during the report period; b) future changes in the interbranch structure of capital investments envisioned in the predictions of the consumer branches (for example, the more rapid growth of capital investments in the fourth and subsequent sections of ferrous metallurgy, in atomic energy engineering, in open-pit mining of coal, and other structural advancements that change interbranch ties between these branches and machine building); c) the elasticity of the growth rates of certain kinds of equipment compared to others which are included in long-range predictions of machine-building branches and reflect, for example, such proportions as the more rapid increase in deliveries of forge and press machines as compared to metal-cutting machine tools, trailer and mounted agricultural machines as compared to tractors, and so forth.

The need to use information from branch predictions in the development of long-term investment matrices is determined by the fact that detailed branch predictions have possibilities of reflecting scientific and technical progress more fully. The advantage of national economic methods of prediction consist in providing for balance coordination of the utilization of machine-building products with the development of the production apparatus of the country as a whole, with the existing general economic limitations.

Exogenous data of branch predictions make it possible to reflect changes in the intrabranch distribution of capital investments among various products, technologies and stages of production.

The classical methods of predicting investment matrices proceed from the principle of distribution of equipment among branches in proportion to the increases in output and the accumulation of stocks of equipment. The distinction of the methods presented above lies in the fact that they are based on the structure of capital investments.

The expediency of developing and realizing these methods is conditioned by the fact that during the period of investment in the economy the demand for equipment depends less and less on the future increases in the production of products, and it is formed to an ever greater degree under the influence of economizing on material resources and increasing labor productivity, including through mechanization, automation and many other factors that are not related to increasing the volume of production, but presuppose a change in the structure of capital investments. Under these conditions a direct changeover from future increases in the output in consumer branches to the physical-substantial structure of capital investments in the national economy, bypassing the stages of the branch, reproduction and technological structure of them, made it possible to obtain only extremely approximate evaluations of the demand for equipment.

The utilization of investment matrices of equipment with long-term predictions makes it possible to promptly reveal and promptly eliminate the disproportions which can be seen in the interbranch ties of machine building between the structural and technical policies of the branches consuming the equipment, on the one hand, and the scientific and construction stockpiles in machine building, on the other.

Investment deliveries account for about 90 percent of the resources of equipment. Therefore the development of the physical-substantial structure of capital investments is the basis for predicting the production of machine-building products.

#### 4. The Block of the Physical-Substantial Structure of Machine-Building Products

The purpose of the block is to provide balance between the needs and capabilities of machine building with the same physical-substantial structure of its output which ensues from the prediction of the physical-substantial structure of capital investments. The block encompasses the following system of predictions: a) the rates of growth and the structure of the demand for machine-building products; b) the resource supply for machine building; c) the structures and readiness of construction stockpiles in machine building.

A prediction of the growth rates and structure of the demand for machine building products presupposes additional inclusion in the calculation of deliveries of equipment for fulfilling in machine building products and the foreign trade balance, and in machine-building products as a whole--the need for other products not included in the calculation of the kinds of equipment, spare parts, durable consumer goods, services and other products. This changeover can be carried out in two directions: a) for individual kinds of equipment in the cross-section of the physical-substantial structure of the investment matrices; b) according to consolidated machine-building indicators. In the present model the second variant prevails. Here the need for applying consolidated econometric methods of predicting the structure of the production of machine-building products instead of the development of partial prediction balances of equipment for each of its kinds ensues from: the lack of partial material balances in value terms for many kinds of equipment; the difficulties in translating for each kind of equipment the exports and imports into domestic prices; and the availability of intrabranch batching of machine-building products for which there are no statistics.

The prediction of the need  $P_k$  for machine-building products of subbranch  $k$  is carried out for large subbranches ( $k = 1, \dots, 11$ ) with the help of econometric dependencies of the type:

$$P_k = \Phi \left( \sum_{j \subset k} I_j, S_k, t \right), \text{ где } \sum_{j \subset k} I_j = \dots \text{ where}$$

--the prediction of the sum of investment deliveries for various kinds of products which are produced by branch  $k$ ;  $S_k$ --foreign trade balance for products of branch  $k$ ;  $t$ --time. The utilization of these econometric dependencies presupposes only one additional independent prediction--of the foreign trade balance--the influence of other constituents of the balance of machine-building products is manifested through the time factor, on the basis of the presumption that the dynamics of this influence will be retained.

Predictions of the provision of metal, labor resources, capital investments and other resources for machine building are based on the system of balance and econometric equations as well as branch production functions. Since individual branches of machine building and also construction attract for consumption various positions of the assortment of ferrous metallurgy products, an analysis and prediction of their provision with metals should be carried out in a differentiated way (smelting, fine sheet rolling, rolled wire and so forth).

In the predictions of the resource provision for machine building one uses as exogenous information the branch indicators of labor productivity in machine building, and the metal-intensiveness, capital-intensiveness and output-capital ratio of its products.

Introduced into the model are exogenous limitations on the possibility of additional enlistment into machine-building production of metal resources (for the basic positions of its assortment) and the allotment of capital investments as well as increased numbers of employees. These limitations ensue from national economic predictions. Their existence presupposes feedback and iterative balancing of the needs and resource capabilities of improvement of the physical-substantial structure of machine-building products.

The calculations conducted by the TsEMI showed that the orientation of the development of metallurgy not toward increasing production volumes, but toward improving the quality of the metal is effective to the extent to which it is coordinated with the possibilities of machine building and construction for complete utilization of the additional quality.

Analysis and prediction of the structure, the readiness and the mobility of construction stockpiles reveal limitations on future advancement in the structure of machine-building capacities which are determined by the inertia of construction programs in machine building.

Analysis and prediction of the limitations on the structure of machine-building products on the part of stockpiles is carried out not for individual objects, but for construction projects as a whole, with a determination of the sequence of the start-up of production capacities (regular and startup complexes). Here construction stockpiles means capacity and value of enterprises under construction minus the capacities and value of previously introduced facilities that are a part of these enterprises. Thus in our analysis the stockpile includes the capacity and value of all objects included in the enterprise under construction, both those that are being constructed now and those that have not yet been started, but not counting those that were introduced previously. Including among enterprises under construction those that have been planned but not yet started makes it possible to considerably increase the horizon of prognostication of future changes in the structure of the production of equipment.

The source of the information for analyzing and predicting construction stockpiles are the title lists of carryover and newly started construction projects for machine building and the report balances of production capacities.

For purposes of grouping, the physical indicators of the capacities were translated into value indicators. The great size of the task (about 930 construction projects for each of which we analyzed about 30 indicators) presupposes as a mandatory condition of its solution the availability of an automated system for processing the title lists.

A simplified diagram of the solution to the problem included calculations of the following indicators:

a) the duration of the construction of  $t_k$  of a unit of production capacity (for producing 1 million rubles of products) in subbranch  $k$ ;  $t_k = \theta(d_{nk}, R_{k1}, R_{k2}, R_{k3}, R_{k4}, R_{k5})$ , where  $d_{nk}$  -- the reproduction structure of capital investment;  $R_{k1}$  -- the level of concentration of capital investments in the facilities of the branch under construction;  $R_{k2}$  -- the proportion of construction and installation work in the capital investment;  $R_{k3}$  -- the average size of the enterprises under construction (in terms of volume of output);  $R_{k4}$  -- the capital-intensiveness of the capacities that are being introduced;  $R_{k5}$  -- the ratio between the economic and the contract methods of construction. For example, for new construction and expansion ( $n = 1$ ) of enterprises of energy machine building ( $k = 1$ ) the dependency obtained from a spatial selection has the form<sup>4</sup>

$$\begin{aligned} \tau_1 = & -0,3672 R_{11} + 0,2990 R_{12} - 0,1643 \ln R_{13} + \\ & (0,066) \quad (0,179) \quad (0,021) \\ & + 0,0658 R_{14} + 0,3657 R_{15} \\ & (0,013) \quad (0,184) \end{aligned}$$

$R^2 = 0,96; \quad V = 0,16; \quad DW = 2,1.$

Such dependencies make it possible to actively influence the future investment lags through the factors  $R_1$ ,  $R_2$  and others as a result of the corresponding selection of construction projects for inclusion in the plan;

b) The introduction of capacities for the given predicted period  $T$ , which are determined on the basis of the selection of those facilities of the construction project, sections and start-up complexes for each of which one maintains the condition  $M_{zkm} t_k$  less than or equal to  $T$ , where  $M_{zkm}$  is the reserve capacity for object  $m$ . The sum of these capacities for all objects

$$\sum_m M_{zkm}$$

characterizes the introduction of capacities for the various title lists of subbranch  $k$ ;

c) The possible volume of  $P_{kt}$  of the production of products of branch  $k$  at the end of the predicted period, determined on the basis of the balance of capacities

$$P_{kt} = \left( \bar{M}_k + \sum_m M_{zkm} + A_k - B_k - N_k \right) \beta_k,$$

where  $\bar{M}_k$  -- the average annual capacity at the beginning of period T;  $A_k$  -- the introduction of capacities at below-limit construction projects and also through capital investments for technical reequipment;  $B_k$  -- the removal of capacities;  $N_k$  -- a change in these as a result of the products list;  $\beta_k$  -- the coefficient of the utilization of the average annual capacity. These indicators are predicted on the basis of an analysis of their dynamics in the period before the predicted one. In the event that  $R_{kt}$  is less than  $R_{kt}^*$ , one carries out an iterative coordination of these indicators which envisions adjustment of those structural changes which have caused the disproportion between the need and the possibility of increasing the production of machine-building products of k kind.

## 5. Directions for Improving the Methodology of Comprehensive Prediction of the Structure of Capital Investments

The practical utilization of the model being considered made it necessary to improve it further in the following areas.

1. The inclusion in the model of the block of the construction complex and metallurgy. This creates conditions for more complete accounting for the influence not only of machine building, but also of construction and metallurgical factors.

As a result of drawing up a model for the development of the entire investment complex, additional possibilities appear for predicting the proportions of the investment branches and reflecting more completely in the national economic predictions the possibilities and limitations on the part of the entire totality of investment resources.

The prerequisites for compiling the block of the construction complex were met as a result of the development of a model of the construction complex in the NIIES of the USSR Gosstroy (8).

The most important methodological instruments for this model are: the inter-branch balance of the complex as a central economic and mathematical model which reveals the main proportions in the development of construction; a model of the type of branch production functions.

The sources of initial information are the national economic predictions of the volumes of capital investments in the production and nonproduction sphere, the structure of capital investments, the limitations on the most important kinds of resources, and so forth.

The objects of prediction are the physical-substantial and value composition of the products of construction and the volume and structure of the demands of

the complex for material-technical and labor resources, including the demand for basic construction materials and construction machines.

Further improvement of the model of the construction complex should envision structuring its products according to the various kinds of construction (agricultural, housing and so forth) and the kinds of construction and installation work (earth-moving, finishing, installation and so forth). The development of the investment matrices of the construction output will make it possible to take into account more fully the existing differences in the needs of the branches of construction for resources and reflect in the national economic calculations the influence of the change in incomplete construction on the structure of the products of the construction complex.

While introducing the block of the machine-building complex into the model makes it possible to reflect more fully the influence of scientific and technical progress more completely in the predictions, the final goal of including the block of the construction complex is directed primarily toward solving another principally important problem--reflecting the regional factor and the possibilities of each branch of construction. In order to solve this problem the future models should provide for balance between the need for construction and installation work and the availability of capacities of construction organizations in the structural and regional cross-sections.

2. The reflection in the model of the utilization of the existing production apparatus. At the present time the value of accumulated fixed capital is approximately 15 times as great as the annual capital investments in the national economy (9, pp 46, 339). Therefore even a relatively small change in the utilization of the existing production apparatus can exert a decisive influence on the need for investment resources and radically change the load on the branches of the investment complex.

The reflection in the model of the utilization of the existing production apparatus will require introducing into it a number of new blocks; balances of production capacities, fixed capital and work positions. For a correct reflection in the predictions of the ties between the increase in products and the increase and startup of production capacities, the future models should provide for coordination of the introduction of capacities, fixed capital and new work positions, on the one hand, and the possibilities of providing them with additional labor resources, on the other.

3. More complete reflection of scientific and technical progress in the model. This includes the following factors: the technical level, quality, renewability of products of machine building and construction, their production apparatus (taking into account the decreased cost of their products per unit of capacities and useful effect); the quality of resources of machine building and construction, including their provision with labor resources of various qualifications, the technical level of batching items, metal-processing equipment and so forth; the development of the scientific potential, the volumes, structure and technical level of scientific stockpiles that act as limitations on the investment activity with a long-term effect; interbranch changes in the structure of products produced and technological means of their

production, which at the present time are taken into account independently when developing long-range investment matrices (for this it is suggested that one increase the number of branches that are consumers of the equipment in the model of interbranch interactions to 70-80 (10, p 296) and the number of positions for equipment in the investment matrices--to approximately 150).

#### FOOTNOTES

1. The conventional aspect of these calculations consists in that they are done with the idea that other conditions will not change--the mechanism for management of the economy, the social position and activity of the workers, the utilization of the existing production apparatus, and so forth.
2. For example, the earmarked increase in the proportion of the output of electric energy at the AES cannot be provided as a result of reconstruction of the TES and GES. For this it is necessary to have a correspondingly high proportion of capital investments in new construction.
3. The growth of the indicator in electric energy engineering, for example, is influenced by accelerated development of atomic energy engineering, in extraction branches--the proportion of open-pit extraction of minerals and certain new technological methods of production, whose capital investments are distinguished by a high proportion of equipment.
4. Indicated in quotation marks as parameters are the values  $t$ --statistics,  $R^2$ --coefficient of determination,  $V$ --coefficient of variation,  $DW$ --Darbin-Watson coefficient.

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REGIONAL DEVELOPMENT

REGIONAL INFRASTRUCTURE PLANNING METHODOLOGY DISCUSSED

TPK Planning Problems Indicated

Moscow PLANOVYE KHOZYAYSTVO in Russian No 7, Jul 85, pp 44-51

[Article by O. Shakhov, sector chief of the Council for the Study of Productive Forces in association with the USSR Gosplan, and Yu. Tsukanov, USSR Gosplan expert: "Methodological Problems in the Planning of TPK's (Using the Example of the KMA Zone)"]

[Text] The overall development of productive forces is one of the most important principles of the socialist system of management. The most efficient form of distributing productive forces is that of the TPK's [territorial production complexes], most of which are formed in newly assimilated industrial regions on the basis of the utilization of highly efficient natural resources. However, in view of the specific nature of the regional conditions and differences in the sector structures of a TPK, it is difficult to compare them and perform a generalizing technical and economic analysis. We can speak only of the unity of the most common methodical approaches in the study and justification of TPK's.

At the present time, considerable experience has been accumulated in the substantiation of scientific forecasts for the formation of individual TPK's, and the results of the modeling of Siberian TPK's have been generalized. In particular, the SOPS [Council for the Study of Productive Forces] under the USSR Gosplan has put together as a preplanning document diagrams of the development of productive forces and the overall utilization of natural resources in each of the eight TPK's included in the plan for the economic and social development of the country's national economy. And long-term special integrated programs have been formulated for the Western Siberian TPK and the Kuybyshev Plant for Automotive Electrical Equipment and Carburetors.

As planning objects, the overall state plans single out TPK's of union significance in the resolution of important national economic tasks. For these TPK's, consolidated plans for capital construction are drawn up, as are the basic indicators for economic and social development for those located in Siberia and the Far East.

One of the main problems of the TPK's is the overall development of natural resources. In forming TPK's on a complex raw materials base, concentration must be accomplished primarily on the basis of the combination of interrelated production systems, ensuring the application of the principles of consistency in carrying out technological processes, the thorough reprocessing of raw materials, and the utilization of by-products and wastes. The economic expediency of this type of concentration ensures an increase in production efficiency and makes it possible to reduce the production cost of the output produced and to utilize the latest technology more fully.

An example of a TPK in the contemporary sense is the TPK of the zone of the Kursk Magnetic Anomaly [KMA], within whose boundaries several economic-growth centers are being formed that are united by a technological chain of production systems which is still far from complete. The reciprocal ties of the developing elements of the TPK production structure in the KMA basin cover the extraction of iron ores and nonmetallic raw materials, the production of ferrous metals, cement and other building materials, and, for the longer term, the output of ferrous metallurgy and a number of associated and auxiliary industries.

In its first stages, the planning of the development of the TPK of the KMA zone was carried out exclusively in the scope of the individual sectors. The initial task in opening up the KMA was the extraction of iron ore that required virtually no enrichment. This task was successfully carried out by ferrous metallurgy, in fact by its subsector of iron-ore metallurgy. The next step was the transition from the extraction of rich ore to the mining of ferriferous quarzites with a low iron content and to the establishment of large-scale mining and enrichment combines. Their output was agglomerate and later high-quality oxidized pellets--the best raw material for production in blast furnaces. The relative share of the latter in the overall volume of the output of ferrous metallurgy in the KMA TPK increased steadily.

A new stage in the development of the KMA TPK was the establishment of the country's first facility for the production of metallized pellets on the basis of a fundamentally new technology and the construction of an integrated electrometallurgical works which is technologically closely linked with this production process and producing its first output in 1984. Thus, the structure of the KMA TPK is changing step by step and its planning mechanism is becoming more complicated. At the present time, a number of subsectors of ferrous metallurgy are represented here--from the extraction of unrefined ore to the most up-to-date production of high-quality electric steel. The development of ferrous metallurgy in the KMA zone could not take place in isolation from other sectors. The assimilation of the riches of the KMA required the establishment of a powerful construction base capable of providing for the industrial construction and overall development of the rapidly growing industrial centers of the KMA--the cities of Staryy Oskol, Gubkin and Zheleznogorsk. Such a construction base has been established and acts an important factor in the concentration of industrial production in the KMA zone.

The construction industry, in turn, demanded the development of its own raw materials base. The dumpings of iron-ore mines and the wastes ("tailings") of the integrated mining and enrichment works could form such a base. Therefore, plans were made for the first intersectorial link-up, requiring coordination and, according to preliminary calculations, capable of providing a substantial economic effect. Under the conditions of sector planning, however, it turned out to be difficult to carry out such a link-up. The necessity arose for inter-sector planning, a necessity that became greater and greater with time.

The pace of development of the KMA TPK is comparable to that of the development of Magnitka and other construction projects of the first five-year plans. To a considerable extent, this was helped by the favorable geographic position of the KMA in the center of the European part of the country. At the same time, however, this location led to an abrupt worsening of the shortage of water resources: the water consumption of large-scale integrated mining and enrichment works inevitably influences the overall water system of the low-water rivers of this region.

The establishment of giant open-pit mines required the allocation of more and more new lands, the vast majority of which represented fertile chernozem fields. Under these conditions (with consideration given to the development of other sectors in the KMA zone, including machine building, sectors in the agroindustrial complex, and the infrastructure), it became necessary to give a territorial aspect to the existing sector planning. The territorial planning of the TPK of the KMA zone set the task of eliminating interdepartmental barriers now hindering the overall development of the KMA zone and capable of leading to more undesirable consequences in the future. At the start of the 11th Five-Year Plan, consolidated plans for capital construction in the TPK of the KMA zone began to be drawn up and confirmed by the USSR Gosplan.

The appearance of consolidated plans for capital construction in the TPK of the KMA zone as guiding documents has great significance in ensuring the overall development of the territory. Indeed, a number of ministries and departments began to show more and more willingness to eliminate interdepartmental barriers that once seemed insuperable. The first practical steps have already been taken in this direction, including the utilization of chalk (mined in iron-ore mines) as raw material for the Starooskolskiy Cement Plant, the conversion of rock into crushed stone, the use of some of the rock from stripping as building material, the improvement of poor lands with chernozem removed in stripping, etc.

It is still too early, however, to say that the planning of the TPK's has achieved the desired effectiveness. The plans themselves do not fully provide for measures to eliminate and prevent disproportions, because the draft of the consolidated five-year plan for capital construction is drawn up based upon the materials of sector studies alone. There is no alternative version. The only preplanning document is the Scheme for the Formation and Development of the TPK of the KMA Zone worked out for each five-year plan by the SOPS under the USSR Gosplan. This scheme includes recommendations to ministries and departments on questions in the overall development of the territory of the KMA zone. These schemes, however, are used only in preplanning work carried out in the USSR Gosplan. As a rule, ministries and departments do not follow

them, since the schemes often run counter to departmental interests. If these recommendations were supported by detailed calculations at the level of the draft of the territorial plan showing the economic effectiveness of the proposed measures, then it is obvious that such a draft would receive more attention from the ministries and departments.

In our view, the schemes are inadequate as the single preplanning document. The practical experience of the first years in the planning of TPK's shows that the necessity arises to strengthen the scientific foundation of territorial planning, not limiting oneself to the mere compilation of sectorial data. As an alternative, planning authorities need territorial drafts of the TPK plan with a significant degree of specificity (calculation of volumes, introduction of facilities, and other planning indicators) that would be based on the recommendations of the schemes.

The main difficulties in resolving questions of the rational distribution of individual sectors of systems are linked with the determination of the national-economic effect from the integrated (total) distribution of labor. A comprehensive analysis of the problems of the efficient distribution of productive forces, being a synthesis of sectorial studies, can make it possible to find the result that would be the closest to the optimum.

Only in the integrated approach to the task of distributing productive forces is it possible to solve the problem of the fullest and most efficient utilization of the manpower resources of various regions of the country. At the same time, the tasks in the rational distribution of industry are not limited to the resolution of purely economic questions. They are very closely tied to the whole range of social problems in the republics and economic regions and to the level of culture, education, medical and domestic services, supply of housing, etc.

The practical embodiment of the idea of an integrated concept requires the application of a systems approach based upon the following very important principles:

--the treatment of the TPK as both a relatively independent and autonomous production and socioeconomic system and as an integral part of the country's entire national economy, as a subsystem of it;

--consideration of the hierarchy in the formation of the TPK production structural in several aspects--sectorial, territorial and temporal;

--combination of descriptive and normative evaluations of the work of the TPK, that is, of the existing state and systems in the functioning of the elements of the complex and the optimum state reflecting the objective publicly essential level of development of the national economy.

The importance of the systems approach is especially obvious in the present-day period, when the entire system of the national economy is rapidly becoming differentiated and more complicated, which is being accompanied by the appearance of new production systems and sectors and territorial forms of management (on the basis of the intensification of specialization, cooperation

and combination). These new forms of distributing productive forces must be met by the most efficient methods for studying them and the most effective management systems. The economic justification of the forecasts for such complex territorial systems as the TPK must be carried out in stages at several calculation levels. What are the methodical approaches at various levels of research that we are already utilizing to some degree in the scheme of the development and distribution of the productive forces of the KMA TPK?

The system of preplanning calculations for the justification of the TPK is presented below.

System of Prognostic Economic Calculations for the Justification of TPK's

| Level  | Method  | Solution  |
|--------|---|---|
| First  | Interregional intersectorial model of distributing the country's national economy | Sectorial structure of TPK  |
| Second | Partial sectorial and inter-sectorial optimizing tasks of distribution            | Specialized types of industrial output, zone of its marketing, intensity of the development of natural resources                          |
| Third  | Production and economic model of the TPK on the basis of material balances        | Calculated balance of all TPK production systems, quantitative expression of production ties, value indicators for the complex as a whole |
| Fourth | Economic and mathematical model of the distribution of TPK elements               | Distribution of enterprises and the scientific organization of the territory of the TPK   |

The long-term planning of the basic directions in the development and distribution of the productive forces of the USSR in the course of the scientific-technical revolution, taking into account the structure of public needs, is substantiated by means of the resolution of the interregional intersectorial model of the distribution of the national economy, covering the entire territory of the country.<sup>1</sup> The basic structure of large-scale TPK's (in accordance with regional resource components) is also determined at this global level of calculations. In practice, use is frequently made of the method of the relative efficiency of various types of production systems in a given region according to annual expenditures of fuel, energy and raw materials per employee.<sup>2</sup>

In relation to the territorial production complex KMA, such calculations indicate a tendency toward the primary development here of production systems with small annual expenditures of fuel, energy and raw materials per employee. The development of a number of sectors of heavy industry is difficult here in view of their large consumption of energy, fuel and raw materials (not to mention a significant consumption of water). In particular, this relates to the siting of plants of the full metallurgical cycle (whose relative consumption of fuel is three times that of plants for casting electric steel) as well as plants of heavy machine building and energy and water-intensive sectors of the chemical industry.

At the second level of calculations using traditional sectorial methods, the efficiency of the development of the production of industrial output is determined with the help of the indicator of the consumer's aduced total expenditures. At the same time, the zone for the sale of the output is substantiated. The zone for the efficient supplying of one enterprise with output can cover several large rayons. Also determined are the degree of intensity of production ties and the complexity of the utilization of natural resources in the formation of production systems on their basis. For example, for the uninterrupted work of metallurgical enterprises in operation or under construction in the European part of the country and the achievement of minimum expenditures for the extraction and shipping of iron ores to consumers, a sequence is established for the development of the KMA's iron-ore deposits and the economically expedient volume of mining is determined for each of them. In carrying out this task, consideraton is given to rational zones for the consumption of iron ores, to the size of reserves and to the technically feasible volume of mining at the deposits. This makes it possible to plan economically sound schedules for the opening up of iron-ore deposits and to determine specific sources for supplying consumers with ore.

The scale of the development of the KMA is determined basically by the developing capacities of the metallurgical production of the European part of the country. Calculations performed by the SOPS under the USSR Gosplan and taking into account the expenditures of associated sectors, considering in particular the water supply and the damage through the loss of lands, etc., showed a significant reduction in the comparative economic efficiency of the development of the iron ores of the KMA basin--to two-thirds [of the compared level]. The capital investments for the construction of KMA mining and enrichment enterprises rise substantially because of the expenditures for recultivation.

The drawing up of a long-term forecast for the development of the KMA iron-ore industry will permit the provision in full of all of its consumers in the European part of the country with iron ore.

In connection with the intensive development of the sectors of the national economy in the territory of the KMA, a pressing question arises about the rational utilization of its potential in natural resources and raw materials. In developing the mineral deposits, we should view the KMA basin not merely as a source of a particular type of raw material but also as a complex of mineral resources composed of metallic and nonmetallic compounds and basic and incidental components. In addition, the iron-ore deposits are an integral

part of nature and their exploitation produces a change in the hydrologic system, the ground and vegetative cover, and the microtopography of the region, which conditions the necessity of considering the influence of the industrial development of the deposits on the environment and the observance of the requirements of the rational use of nature.

The rational utilization of mineral and raw-material resources must primarily be directed toward the reduction of operational and technological losses. According to preliminary estimates, each percent of iron not extracted at the present-day volume of production of iron-ore concentrate at the KMA enriching enterprises costs the national economy almost 2.5 million rubles. Consequently, an increase in the completeness of the extraction of minerals from the depths and the extent of their enrichment are a very large reserve for the intensification of KMA mining enterprises.

An extremely complex problem in the fulfillment of the plans for the development of the KMA is that of the establishment of large-scale construction bases in the basin and especially that of supplying them with building materials. Therefore, the utilization of incidentally mined minerals will, to a significant degree, make it possible to cover the shortage of nonmetallic building materials in the KMA region and will give additional profit to the mining and construction enterprises. One of the main tasks in this connection is that of the acceleration of the prospecting of stripping rock in the project contours of the open-pit mines and the study of the industrial properties of the rock for the purpose of determining the feasibility of using it for the industrial production of materials for various sectors of the national economy. An important question in the comprehensive utilization of the basin's minerals involves the development of the industrial processing of incidentally mined oxidized quarzites.

The comprehensive development and utilization of minerals, including incidentally recovered minerals, is one of the directions in the resolution of the problem of protecting the basin's environment. Thus, the transition to low-waste and no-waste enrichment technologies with closed systems of water turnover will have tremendous importance for the rational use of nature.

Among the aspects of the management of environmental protection, an important role is played by the evaluation of natural resources (for the determination of the aggregate rent), which may be of economic interest to economic organizations in the rational use of natural riches. The evaluation of the interrelationships between the society and nature makes it unavoidable to consider not only the economic effect from the direct utilization of raw materials but also as a factor which influences the efficiency of other sectors of the national economy and the public health through the condition of the air and water reservoirs and landscapes. In the comparative prognostic calculations for the development of the KMA basin, it is thus essential to be more involved in specifying national economic expenditures; that is, along with traditional sectorial expenditures, to consider a whole series of related expenditures which are primarily linked to characteristics of the ecological situation (allocation of lands, recultivation, problems in the reduction of underground water tables, the increase in the value of water resources, etc.). At the present time, the Provisional Methods for the Determination of the

Economic Efficiency of Expenditures for Environmental Protection Measures issued by the Economics Institute of the USSR Academy of Sciences may serve as a guideline for such calculations.

At the third level of prognostic calculations, use was made of the method of the formulation of an economic-production model of the complex with the sectors of the production infrastructure and related production systems on the basis of the coefficients of direct physical inputs. The latter reflect the prospects for technical progress for the period of reference. The model considers all production systems of the complex and indicates outlays of raw materials, fuel, energy, water and manpower. This makes it possible to express things in terms of costs and also to apply economic and mathematical modeling. The intraorganizational conditions in the development of the production complex can be expressed in equations of the intersectorial balance of production and the distribution of output.

The establishment of a new iron-ore base for the country at the KMA deposits determines the direction of the development of a complex of interrelated industrial sectors. In the 11th Five-Year Plan, along with the production of steel and rolled products, here we see the emergence of new production of building materials based upon the use of the stripping rock of open-pit mines, machine building plants for the repair of mining and enriching equipment, and enterprises of light industry (to provide jobs for the families of miners). The region's suburban agricultural and service sectors are developing rapidly.

The enumerated stages of prognostic calculations had to do with the production structure of the TPK. At the fourth level of calculations, the distribution of the enterprises of the complex in a specific territory is substantiated and questions about the organization of the latter in the formation of a large-scale TPK are resolved. The fourth level of calculations includes a balanced coordination of the development of the sectors of the production and nonproductive areas in the territory of the TPK, the development of economic-growth centers with suburban agricultural and recreation zones, the development of a settlement system, and nature utilization and the preservation of the sanitary and hygienic conditions of vital activities. In short, it is essential to substantiate the intelligent functioning of all parts of a large territory. It is thereby expedient to perform consolidated calculations of expenditures for its long-term development. Thus, as a function of the growth of the population and its settlement patterns, expenditures will vary for cities of a particular category and for rural areas.

The proposed planned organization of the territory makes it possible to concentrate all material means on the development in regional centers of construction bases and construction-industry enterprises, bases for the material and technical supply and servicing of the industrial enterprises of the regions, and institutions in the area of services to the populace of the regions. The development of a network of economic and cultural centers will permit a sound approach to the resolution of questions associated with supplying the public with intraregional transport, recreation zones, etc.

The formation of prospective centers of economic growth is of particular interest from the point of view of the organization and planning of the economy. The compactness of a territory and a high concentration of industry usually help to establish intensive interrelationships among enterprises in cooperation and integration. They may be either organic ties in the technology of the production of certain types of output or permanent ties for the purpose of organizing a unified system of auxiliary production processes for a group of enterprises producing different types of output (unified construction, repair and energy base, transport center, water supply system, etc.). The establishment of such organic ties among individual production systems helps in the shunting of capacities and resources and, in the final analysis, it helps in saving capital and operational (including transport) expenditures. Within a center, as a rule, several such combinations of industrial enterprises may be formed. The centers differ in their specialization, size and degree of complexity. The Belgorod-Yakovlevo, Oskolskiy and Zheleznogorsk centers are among those undergoing the greatest development in the territory. In considering the particular characteristics of the specialization of the developing mining centers in the future, we should not permit the rise of disproportions here in the area of the application of the labor of men and women.

At the fourth level of calculations of the economic efficiency of national economic complexes, a model is being developed for the intraregional distribution of productive forces. The necessary information can be obtained through engineering calculations under a multiple-factor evaluation of the industrial sites of the cities in the territory of the complex. The factors are the following: presence of industrial sites within the city limits and additional expenditures to open up unproductive lands and reconstruct built-up territories for the purpose of industrial construction, the demographic factor and expenditures to attract manpower resources from outside, and local raw materials and water resources and their evaluation. Other important factors include: the presence of a production base for the construction industry and additional expenditures to develop it; the conditions of the power, gas and fuel supplies and the evaluation of their long-run marginal costs; industrial concentration and ecological conditions and additional expenditures to protect the environment; the determination of the functions of cities in the settlement system.

One of the ways to preserve valuable agricultural lands in the region and to improve the environment involves the intensive growth of cities (use of unproductive or waste lands within the city limits, increase in the number of stories of buildings, and replacement of deteriorated low-rise housing).

The problem of the improvement in the management of the TPK's needs to be resolved. The problem is especially acute in regard to the development of a large basin whose deposits are complex in nature. In this case, the mining of two or three types of raw material at one mining enterprise by different departments (different cost-accounting organizations) leads to excessive expenditures for technical equipment and to organizational conflicts. It is precisely because of the bureaucratic approach that the problem of the comprehensive utilization of useful components of stripping rock in the KMA basin has not yet been resolved.

It is our view that in the future, within the boundaries of each iron-ore region (Staroskolskiy, Novoskolskiy, Belgorodskiy and Orlovsko-Kurskiy) in the territory of the KMA basin, it will be expedient to establish large-scale intersectorial scientific-production and production associations (combines) constructed under the territorial principle for the comprehensive processing of raw materials. The complex utilization of minerals must be helped by the application of a definite system of accounting and control over the completeness of the extraction and the complexity of the processing of minerals and also by a system of economic measures (including the introduction into joint output of methods for the unified calculation of expenditures) stimulating the material incentive of all workers for greater production and utilization of mineral resources and for their proper stockpiling and storage--in essence, that is, for the implementation of a wasteless technological process.

#### Production Infrastructure Planning Analyzed

Moscow PLANOVYE KHOZYAYSTVO in Russian No 7, Jul 85, pp 60-66

[Article by V. Oreshin, candidate of economic sciences: "Methodological Questions in the Planning of the Production Infrastructure"]

[Text] Under the conditions of the reorientation of the national economy toward the intensive type of reproduction, there is an increase in the role of such factors as the intensification of the division of labor and the development of specialization and cooperation in public production. This problem is especially pressing for machine building and agriculture. In machine building, it is a matter of the transition from a collection of mainly universal enterprises to a system of highly specialized and highly efficient enterprises. In agriculture, in addition, the task is to develop the interzonal specialization of production, in particular to concentrate the production of two or three crops in zones most suitable for these purposes. In both cases, with the introduction of new forms of organizing production, there is an increase in the volume of cooperative deliveries of output and in the load on transport, communications and warehousing--everything that is usually called the production infrastructure.<sup>3</sup>

The necessity of distinguishing the production infrastructure as an independent object of planning is linked to the tendency toward the operation of large-scale diversified formations in the justification of the long-term prospects for economic and social development.

The published methodological materials on the planning of the development of inter-sector (or, more accurately, multisectorial) complexes reflect the problems in the planning of the APK [agroindustrial complex], the TEK [fuel-energy complex], construction materials, machine building or the entire investment complex.<sup>4</sup> At the same time, the problems of the comprehensive planning of transport, communications, and material and technical supply have not been worked out adequately, even though it is possible to resolve the problems of the production infrastructure effectively considering them only as a single interrelated whole.

Approaching the infrastructure as a totality of interconnected sector production systems makes it possible, in proceeding from an orientation toward the achievement of superior final results, to apply more rationally the tremendous production potential accumulated here.

Its long-term planning is based upon the same principles as the planned management of the base sectors of physical production: the all-round validity of planned tasks proceeding from the production possibilities of the infrastructure sectors and the requirements for their services and from the labor, scientific-technical and financial limitations in the development of a given facility; and the distribution of the indicators of the sector plan in the territory of the country and their close coordination with the plans for the development of the territories.

In addition, one must consider the specific nature of the production infrastructure as an object of planning:

--the dependence of the volume of its work (services) upon the development, location and organization of industry, agriculture and construction;

--the unity of the processes of the provision and consumption of services and the impossibility of accumulating and storing their output, which raises the acute problem of the establishment of reserve capacities here;

--territorial non-interchangeability, requiring a specific correspondence between the locating of productive forces in the territory of the country and the territorial development of the facilities of the infrastructure;

--the time lag in development, long periods for project planning and establishment, a high level of capital-intensiveness and output-capital ratio determining the distribution of the effect from the development of the facilities of this complex for a long time, and the necessity of having expenditures and their effect coincide at one point in time;

--as a result of the servicing nature of the sectors of the production infrastructure and shortcomings in pricing its services. The economic effect from its work materializes and is discerned not only in the infrastructure itself but also in the sectors of physical production served by it.

In planning any national economic facility, including the productive infrastructure, the development of an adequate system of indicators has very great significance. In the practice of the analysis and planning of the production infrastructure, use is made of a system of indicators of the functioning and development of its individual sector components, such as transport, communications, trade, material and technical supply, and marketing. Indicators that give the complex a single specific function and that reflect the connection between sectorial elements of the infrastructure are still awaiting elaboration.

A system of indicators for the production infrastructure is defined as an interrelated aggregate reflecting the state of the facility (primarily its

material-technical base): the magnitude of additional resources allocated to its development; the amount of work performed and the indicators of the efficiency of the application of production resources; and indicators of the interaction of its sector elements.

Since the infrastructure is part of a single national economic complex, a system of indicators must reflect its direct and inverse ties with other multisectorial complexes (fuel-energy complex, machine building, construction materials, APK) along the lines of the demand for services of a production nature and deliveries of material resources for its development.

There are two kinds of ties between the structural elements of the infrastructure--the quality of being complementary (when the development of one sector or facility objectively requires the corresponding development of another sector or facility) and interchangeability (when the development of a given sector or facility makes it possible to loosen requirements for the development of other sectors or facilities). Thus, the widespread use of containers and large-capacity packaging presupposes the corresponding development of loading and unloading operations, means of packing shippable output, and automation of the paper flow.

The development of communications ensuring timely and complete information on the existence and movement of output can substantially reduce cross hauling of freight and cut transport work by a corresponding amount. It can provide the same help to warehousing, the field of information, and production services.

Since the infrastructure is a factor in the acceleration of economic growth, a system of indicators must reflect not only the sectorial but also the national economic efficiency of public labor applied in this area.

A very complex problem in developing an adequate system of indicators for the infrastructure is the presentation of a given complex as a single interrelated whole. One of the ways to solve this problem involves the establishment of a subsystem of specific indicators of the development of the infrastructure in the form of a linked collection of indicators characterizing the quality of operation of the system of production services: the speed of the turnover of material resources in the process of public reproduction, the mobility of production stocks, the reduction of output losses in the process of its movement from the producer to the consumer, and the conditions for extending the division of labor and for the development of production specialization and cooperation.

At the present time, there are a number of shortcomings in the area of infrastructure planning, in particular the low level of validity of the planned tasks for the long-term development of its sector components and the existence of a difference between the planning of generalizing macroeconomic magnitudes and the calculation of technical and economic indicators, the noncomprehensive planning of sectors included in the system of production services, and the use of an intra-sector approach not only in medium-term and current planning but also in long-term calculations.

To eliminate these shortcomings and to raise the level of the planning of the production infrastructure, three tasks have to be carried out:

--transform it into the object of planning decisions based upon the performance of economic calculations using cost indicators;

--introduce the procedure of matching supply and demand in justifying planned tasks;

--develop a methodology for the integration of sectorial components and facilities of the production infrastructure.

In the planning of the sector components of the infrastructure, as a rule, use is not made of the indicators of efficiency based upon cost evaluations because of shortcomings in the system of prices and charges for services of a production nature. There is a discrepancy between the amounts of production resources applied in the sectors of the infrastructure and the cost evaluation of gross output. This is where 22.5 percent of the total number of employees in physical production are working, where 26 percent of fixed production capital is used, and where more than 27.4 percent of production capital investments occur. At the same time, only 12.8 percent of gross public output is produced in the infrastructure. The basic reason for this discrepancy is the low charges for infrastructure services, and this is why the effect from its work is reflected in the work results of other sectors of physical production.

In our view, it is essential to lay the groundwork for obtaining the corresponding national economic effect in the sectors of the infrastructure. For a sound evaluation in cost terms of the volume of gross output produced in these sectors, it is proposed that the idea of the equal efficiency of public labor applied in various areas of the economy be adopted. Acceptable for the realization of this idea, in our view, is a national-economic production function calculated by means of the processing of time series for past years.

For the purpose of obtaining a more valid value for the gross output of trade, it is necessary to correct its volume published in the statistical reporting by the amount of the turnover tax. According to our estimates, the turnover tax, collected in the area of circulation, amounts to about one-third of the gross output published in the statistical reporting. Without this amount, the volume of gross output in the area of circulation amounts to 68.5 billion rubles. The deviations in the reporting indicators and calculated size of output for individual sectors of the production infrastructure are presented in the table.

Thus, only 54 percent of the output actually produced in transport is reflected in the value of output calculated according to charges in effect. In trade, material and technical supply and procurement, the extrasectorial effect of their activity is somewhat less, amounting to 17 percent.

Gross Output in 1983 (billions of rubles)

| Calculated according to the methods of the USSR Central Statistical Administration | Conditionally calculated according to the methods of the author | Deviations between reporting indicators and the calculated size, by infrastructure sector |
|--|---|---|
| Transport and communications . . .   | 58.0  | 108.6   |
| Trade, material and technical supply, etc. . . . .                                 | 68.5*   | 82.6  |
| Infrastructure, total . . . . .  | 126.5   | 191.2   |

\*Not including turnover tax

The presence of a "price scissors" for the output of base sectors and the services of the production infrastructure is not an inherent law in the development of socialist production, although it does exert a substantial influence on the development of the economy.

The low level of transport charges brings together geographic points, as it were, making the consumption of the output of geographic zones at different distances equivalent for the consumer, and it helps to promote the opening up of remote regions of the country (Siberia, Central Asia, the Far East) but, at the same time, it distorts the economic efficiency of the work of the transport system and other sectors of the infrastructure. Their development appears to be economically unprofitable, which does not correspond to reality.

In calculating the planned indicators of the conformity of the demand for the services (work) of the sector components of the infrastructure to the production possibilities (throughput) of these sectors, a number of tasks arise whose execution has not been adequately substantiated methodologically, including:

- a calculation of the requirement for the services (work) of its individual sector components in the complex as a whole;
- justification of the throughput of the infrastructure (its sectorial components) and its dynamics in time;
- matching of its throughput and the requirement for its services at the most efficient basis.

The methods for the planning of the requirement for the services (work) of the production infrastructure must be differentiated according to the stage of the planning work and the required degree of validity of the planned indicators. It is possible to apply a simplified factor approach in the preliminary stage

of the planned justifications and a standardized-balance calculation in the stage of the development of the draft plan.

At the present time, a single-factor approach<sup>5</sup> is recommended for the preliminary calculations of the requirement for the services (work) of freight shipping, where the volume of gross social product is seen as the decisive factor. In reality, the set of factors determining the level of the demand for the services (work) of the sectors of the production infrastructure (including freight shipping) is considerably larger. Even in simplified calculations, it is essential to consider at least such points as shifts in the territorial structure of production (the share of remote northeastern regions in the volume of produced output, for example), changes in the sectorial structure of production (including in the share of transport-intensive production systems in the structure of social product), the improvement of the forms of organizing public production (level of production specialization and cooperation, development of centralization and concentration of production), and the place of the country's economy in the international division of labor.

In addition, the need for transport services is influenced by the achieved level and rate of development of other sectors included in the infrastructure, especially the warehousing system, communications, the container-packaging system, etc. It is therefore more valid, in our view, to calculate the requirement for the services (work) of the production infrastructure by using multi-factor functions with the inclusion of the above-named factors as independent variables.

The type of function used can vary, beginning with a simple linear function and ending with more complex linearizing and nonlinear functions.

Let us take a look at a multi-factor exponential linear function in logarithmic form, whose parameters are fairly easy and simple to interpret economically.

$$Q = AX^{d_1} R^{d_2} K^{d_3},$$

where  $Q$  = volume of freight turnover  $t$  X km;

$A$  = coefficient for relating the function  $Q$  and the independent variables  $X$ ,  $R$  and  $K$  to one dimension;

$X$  = volume of produced output measured either in cost terms--gross social product in rubles--or in physical terms--volume of the production of transport-intensive output,  $t$ ;

$R$  = indicator of the distribution of output in the territory--the share, for example, of production in the country's eastern regions;

$K$  = coefficient reflecting shifts in the forms of organizing public production (level of its specialization and concentration);

$d_{PT1,2,3}$  = coefficients of elasticity of the volume of freight turnover for one factor or another

Similar factors determining the requirement for the services of subsystems of the production infrastructure can also be singled out in the planning of material and technical supply, communications, and practical services. As a rule, the list of factors varies based upon the specific nature of the

planned facility. However, the general principles for carrying out plan justifications remain valid.

More reliable is a balance calculation of the need for the services (work) of the sectors of the production infrastructure based upon the utilization of a system of scientifically substantiated standards. The essence of the calculation lies in the development of a system of interconnected balance tables sequentially reflecting the stages in the movement of the output in the process of public reproduction--such stages as the production of output and its distribution by place of utilization, yielding the determination of the volume of transport work for each separate type of output produced and later for the overall volume of production and services in communications and in the storage, final preparation and sale of output. With the help of a checkerboard of interregional shipment flows, the integration of such production-transport-storage balances characterizing the transport and economic ties of regions will make it possible to derive the planned volumes of shipments, storage of output, freight turnover, and communications services.

Balance calculations of the need for the services of infrastructure sectors, which have been worked through fairly well methodologically, are still not finding broad application in the practice of plan justifications because of their complexity and laboriousness. The task, therefore, is to transform this system of calculations into a handy set of tools for planning work.

Let us consider the methods for the justification of the throughput of the infrastructure and its sector components.<sup>6</sup>

Some complex problems in the area of the analysis and planning of the throughput of the production infrastructure are the evaluation of its individual links and the relating of the throughput of individual sectorial subsystems to the throughput of the infrastructure complex as a whole. Such calculations are essential for valid planning of it through the matching of the possible volume of services of a production type with the requirements of base sectors.

Another aspect of the utilization of the integral evaluation of the throughput of the infrastructure as a whole is that of the calculation of the volume of expenditures of production resources (capital investments and manpower and material resources) to lay the groundwork for ensuring the prescribed throughput level of the infrastructure and to achieve the necessary quality of production services.

The basic methods in the planning of the level and dynamics of the infrastructure throughput are the factor method and the method of technical and economic justification. The essence of the factor method involves the fact that to determine the list of factors governing the state and dynamics of the production capabilities of the infrastructure as a whole and of its individual sector links, including their changes, it is more or less valid to calculate its throughput in the planning period. In this connection, some factors or independent variables are the volumes of production resources allocated to the development of infrastructure facilities and how they are

distributed. The method of technical and economic justifications is more complex and more reliable. It presupposes the broad use of various sorts of technical and technological standards as well as a system of balance calculations at various levels.

To match throughput to the requirement for infrastructure services, use is now being made of the balance method providing for the development of a balance table, one part of which reflects the justified requirement for the work of the infrastructure and another part of which reflects the magnitude of the throughput. Such tables must be drawn up both for the infrastructure as a whole and for its individual sector components. One of the most complex tasks is to express the infrastructure throughput and the need for its services (or for those of its individual link) in the same units. In justifying a variant for the satisfaction of calculated requirements, it is possible to apply optimizing methods.

In the course of the search for a coordinated variant of the development of the production infrastructure, the balance method can be used to determine the extent of losses from the lack of agreement between the throughput and the demand for the services (work) of the infrastructure.

An important aspect of the improvement of infrastructure planning is its presentation as an interrelated whole with a single specific purpose in the process of public reproduction, a more or less uniform technology in the provision of services and, preferably, a single authority responsible for the effective functioning and development of a given subsystem of the national economy.

Some problems in the production infrastructure can be resolved within the framework of the planning instruments now being employed. The resolution of other problems requires the application of special methods associated with the utilization of a specific program approach.

In view of the importance of improving the production infrastructure to put the economy on the path of intensive development, the urgent necessity arises of formulating and realizing a number of comprehensive programs for its accelerated development, namely:

--a long-term program for the development of the country's infrastructure complex as part of the Comprehensive Program for Scientific-Technical Progress;

--specific programs for the development of the individual sector components of the production infrastructure that are obviously lagging further behind and where no solution is possible within the framework of traditional planning methods (development of a network of local highways, a packaging service and a local power grid);

--a program for the comprehensive development of the production infrastructure in particular regions of the country.

In developing a comprehensive infrastructure program, great significance is attached to the precise determination of specific indicators for its development, which can be expressed either as a vector of the demands of base sectors for the development of the infrastructure and its components or as tasks in the development of its material-technical base.

In the first case, the specific indicators for the development of the infrastructure are formulated in indicators of the efficiency of the work of the base sectors of material production. Specific indicators reflecting the demands of users for the development of the production infrastructure may include: the establishment of the necessary material preconditions for setting up public reproduction in forms providing for a particular level of division of labor and development of cooperative ties among producers, and a reduction of losses of working time because of the mistiming and incompleteness of deliveries as a result of the lack of development of the production infrastructure as well as losses of output in the process of its movement from the producer to the consumer in the infrastructure channels.

In the second case, the specific aims of the development of the production infrastructure are formulated as indicators of the status and dynamics of the facilities of the system of production services or even in indicators of the volumes of production resources needed for the establishment of these facilities. Such specific indicators may include: the level of the provision of production, the territory and the public with infrastructure facilities such as, for example, the length of highways per hectare of agricultural land; the provision of capacities for the storage of the total harvest of agricultural crops; and the furnishing of containers, packaging, etc. for shipping.

In our view, a more valid variant of the task of specific purposes in the development of the infrastructure is the first, inherent in the functional purpose of the system of production services and more fully reflecting the national economic approach to the evaluation of the effectiveness of the variants of its development. Its practical implementation is, however, extremely complex. Here a quite complex and as yet unresolved task arises: that of finding an adequate transition from the indicators of the forms of the organization of public production and the losses of output and working time to more specific indicators of an address nature for the development of the facilities of the production infrastructure.

#### FOOTNOTES

1. S.A. Nikolayev, "Mezhrayonny i vnutrirayonny analiz razmeshcheniya proizvoditelnykh sil" [Interregional and Intraregional Analysis of the Distribution of Productive Forces], Moscow, Nauka, 1971, pp 137-182.
2. "Tsentralny ekonomicheskiy rayon" [Central Economic Region], Moscow, Nauka, 1973, pp 63-72.
3. In the given work, the production infrastructure is viewed as a multiple-sector complex having the function of ensuring normal conditions of public reproduction by providing services in the transport of output and

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its storage, final preparation and sale, and also as a complex of an informational and practice nature.

4. "Problemy razvitiya i planirovaniya mezhotraslevykh proizvodstvennykh kompleksov" [Problems in the Development and Planning of Intersectorial Production Complexes], edited by I.M. Denisenko, Moscow, Economics Institute, 1979; A.R. Liebkind and A.I. Rudnik, "Problemy razvitiya mezhotraslevykh kompleksov" [Problems in the Development of Intersectorial Complexes], Moscow, Central Economics and Mathematics Institute of the USSR Academy of Sciences, 1981.
5. "Metodicheskiye ykazaniya k razrabotke gosudarstvennogo plana ekonomicheskogo i sotsial'nogo razvitiya" [Methodical Instructions for the Elaboration of the State Plan for Economic and Social Development], Moscow, Ekonomika, 1980.
6. The throughput of the sector component of the production infrastructure is defined as the maximum-possible volume of work performed of a specific type per unit of time under the given conditions.

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REGIONAL DEVELOPMENT

SPECIAL PROBLEMS CONFRONT AZERBAIJAN DEVELOPMENT

Moscow PIANOVYE KHOZYAYSTVO in Russian No 7, Jul 85 pp 112-114

Article by S. Divilov, AzSSR Honored Economist: "Some Problems of AzSSR Industrial Development"

Text In the course of the last three 5-year plans, considerable successes have been achieved in the industrial development of the republic. Thus, between 1971 and 1983, 170 new large enterprises were put into operation, new shops and production units built at 130 existing ones and about 70 percent of the industrial fixed capital replaced. The value of productive industrial capital at the end of 1983 stood at more than 9.8 billion rubles, almost twice as much as in 1970. Industrial production rose during that period 2.6 times.

The main direction in the development of the republic's economy remains the accelerated development of those sectors which ensure industrial progress and steady and balanced expanded reproduction. This work will be combined with a technological overhaul of the basic industries (electrical energy, fuel, chemicals and petrochemicals and machine building) and with an improvement of coordination between extracting and manufacturing industries, between the producing and the consuming. Owing to the development of the industries which determine scientific and technical progress and provide a fuller utilization of AzSSR natural and labor resources, since the start of the five-year plan production targets have been reached in electrical energy, natural gas, plastics and synthetic resins, sulphonol, cotton fibers, silk fabrics, vegetable oils, canned fruit and vegetables, wine and wine products, whole milk and milk products, mixed animal feeds, etc.

The construction materials industry outpaced the five-year plan's growth rate targets by 2.6 percentage points; the timber, woodworking, pulp and paper industry, by 1.5 percentage points; nonferrous metallurgy, by 0.7 percentage points. The highest growth rate has been achieved in the food industry. During the 1981-1983 period the industry's production volume grew 31.5 percent, compared to a target of 15.9 percent according to the 5-year plan.

On the other hand, during the three years of the 5-year plan a number of sectors in heavy industry have been falling short of their production growth rate targets. Among them is electrical energy, which fell short by 4.3 percentage points; machine-building and metal-working, which fell short by 1.8 percentage points and chemical and petrochemicals, which fell short by 0.8 percentage

points. Light industry lagged considerably, by 4.1 percentage points, primarily because consumer goods enterprises did not fulfill their plans. As a result, production of the means of production (Group A) in the past years outpaced production of consumer goods (Group B) approximately by 1 percentage point, whereas the 5-year plan requires it to grow 3.2 percent faster than Group B. This has been reflected in the sectorial structure of industry.

It is a known fact that the structure of the republic's industry and many indicators differ substantially from the average union values. Thus, the share of the industries that determine scientific and technological progress in the economy is 8.2 percentage points lower in the production volume of the AzSSR than for the country as a whole. This causes the need for the implementation in the republic of a set of measures designed to raise the share of the industries that determine scientific and technological progress to at least 40 percent, which includes raising the share of the machine-building and metal-working industries to 30 percent.

Despite the successes achieved in recent years in the development of the economy, the lag in the production of national income per capital has not been overcome (in 1983, that indicator in the republic was only 73 percent of the average-union level). Therefore, in implementing a republic structural policy it is necessary to develop primarily industries that are not materials intensive but are labor intensive in order to increase employment of the able-bodied population. The share of the republic's able-bodied population that is not employed in social production is approximately four times higher than in the nation as a whole. At present, the AzSSR is characterized by the relatively low labor intensiveness of a number of types of products of the manufacturing industries. Thus, in 1982 the share of the cotton-ginning and vinicultural subsectors in the republic's industrial volume was 22.6 percent, and the share of the light and food industry was around 50 percent.

Apparently, a special place in the republic's industry will be assumed by machine-building and metal-working. According to physical and value balance data, the inflow of these industries' products during 1982 topped the outflow by 212 million rubles; some 1.083 billion rubles' worth of machine-building and metal-working products were brought into the republic.

The necessity of a faster-than-average development of the machine-building and metal-working industries is determined not only by the republic's need for their products and the requirements of scientific and technical progress, but also by a number of advantages.

First, machine building is mobile; many of its subsectors--electronics, radio engineering and instrument making--are not material-intensive and can be placed in small and medium-size cities, where unemployed labor is mainly concentrated. Machine-building plants fits together well with plants of the light and food industry.

Secondly, of all the basic industrial sectors, machine building requires the least capital investment to create new jobs. Thus, according to 1971-1980 data, to create one work place in the republic's industry required, on average, 65,000 rubles in capital investment; yet, in the machine-building and metal-working

industries, it required only 15,000 rubles, or 4.3 times less. Moreover, placing these industries' plants in small or medium-size cities will require relatively small expenditures to create the necessary infrastructure.

Thirdly, the machine-building and metal working industries are the most labor-intensive. Thus, in 1982 to produce 1 million rubles' worth of commodity output in these industries required 85 workers, compared to the average of 36 workers for the republic's industry as a whole, or 2.4 times more. Wages in these industries are also higher. In 1982, wages (including social insurance deductions) were 8.2 percent of the total expenditures for the production of industrial output, whereas in the machine-building and metal-working industries they were 18.8 percent, or 2.3 times larger.

An important place in the republic's economy is occupied by the oil industry. The republic currently has 13,700 functioning wells. During the period of their industrial exploitation they produced 1.2 billion tons of oil and an enormous quantity of gas.

The depth of wells has increased. Now around 66 percent of all oil and 95 percent of all gas is extracted from off-shore deposits. Mainly because of this, expenditures per unit of production have risen. At present, 60 percent of all investment in the republic's industry goes to the fuel and energy sectors. The uniqueness of AzSSR oil for the production of certain petroleum products is well known.

The oil industry is a leading and profitable sector of the republic's economy and it provides the basis for the development of other industries: oil refining, gas refining, electric energy, petrochemicals, and oil machinery building. In essence, there has been created a large industrial complex of national importance, with a total production volume of about 2.03 billion rubles in 1980, or 22 percent of total AzSSR industrial output.\* Moreover, for each ruble in the oil and gas extraction subsector, in the associated industries there was 6.6 rubles of production in 1980, compared to 4.1 rubles in 1970--or 1.6 times more. This shows the further intensification of the processes now under way in the oil and gas industry complex, as well as its enormous internal potentialities which must be exploited in the future. This complex now employs 83,000 workers, or 20.5 percent of all those employed in the republic's industry.

AzSSR still remains one of the promising oil producing regions of the country. This means that enough funds must be allocated to achieve not only stabilization but growth of oil and gas production in the future. For the acceleration of discovered new oil and gas deposits and the estimation of potential oil and gas resources it is important to increase the volume of geological-geophysical

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\*Calculations of this production volume for electrical energy omit hydro-electric plants' generation; calculations of the oil-processing industries' output omit processing of raw materials originating outside the republic. Associated production units in other industries are not included either. The data is given in enterprise wholesale prices as of January 1, 1975. In enterprise wholesale prices as of January 1, 1982, the 1983 volume of the complex exceeded 2.3 billion rubles.

and prospecting work, and of exploratory deep drilling; the providing of the industry with modern technology, especially for work at sea; the intensification of scientific research and the training of skilled personnel. Finding a solution to this problem is a national task.

Some work has been done in the republic to develop a network of vocational-technical schools. In the 13 years between 1971 and 1983 it increased almost 2.4 times: 61,200 skilled workers were trained, 19,700 of whom were trained in industry. Calculations show that in the future the number of skilled workers being trained for industry annually in the vocational-technical education network should be raised to roughly 30,000 a year. This also takes into consideration the fact that skilled personnel would be entering industry from secondary schools in connection with the implementation of the reform of the general education school system, and that the work of assigning and training personnel on the job would be improved. It is desirable to establish schools in regions where new enterprises are being set up taking the availability of free labor into account. Moreover, the number of secondary specialized schools, especially those geared toward newly created industries, must be drastically increased.

Further improvement of the sectorial and intra-sectorial structure of the industrial production will allow one to broaden the assortment and designation of consumer goods in the republic, to improve their quality and to assure that they are produced in quantities sufficient to fulfill the needs of the population. All this will allow one to solve important social and economic problems more rapidly.

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ACADEMY ECONOMIST VIEWS IMPACT OF NEW TECHNOLOGY ON ECONOMY

Moscow EKONOMICHESKAYA GAZETA in Russian No 32, Aug 85 p 9

[Article, under the general rubric "The Economic Mechanism of Intensification" and the specific rubric "New Generations of Machinery," by Doctor of Economic Sciences Yu. Yakovets, department head at the USSR Council of Ministers' Academy of the National Economy": "National Economic Effect and Prices"]

[Text] Machinery, as is known, develops along two paths: the revolutionary and the evolutionary. Periodically a transition to new generations of machinery takes place. Following that comes a period of the evolutionary development of the generations of machinery that have been put into production--improved models appear, individual parameters are improved, and the economic effect in various spheres of use is realized more fully. And this continues until the very foundation of a given generation of machinery becomes obsolete, having exhausted its economic potential.

The revolutionary and evolutionary paths of development of machinery do not exclude but complement one another. However, at various stages of development one path or the other may receive priority. At present it is precisely a revolutionary leap in the development of the society's machinery base that has become an urgent necessity.

At the CPSU Central Committee's April plenum it was emphasized that "the main task is to shift rapidly to the production of new generations of machines and equipment that are capable of bringing about the introduction of progressive technology, raising labor productivity many times over, reducing materials consumption, and raising the return on assets."

Toward New Generations of Machinery.

In our view, one can single out two characteristic features that distinguish new generations of machinery.

In the first place, there is the fundamental innovativeness of machinery that embodies a fundamental scientific discovery or a major invention. In this connection, one can speak of two levels of innovation: the development and introduction of fundamentally new machinery that is being put into production for the first time in the USSR but is already being used abroad; and the

putting into production of pioneering machinery that surpasses everything that is known abroad and is distinguished by greater competitiveness in foreign markets.

In the second place, the shift to a new generation of machinery leads to a qualitative leap in its effectiveness, and an improvement of the quality and reduction of the cost of products produced with the use of this machinery. Therefore, a fundamentally new approach is required to determining the effectiveness of new generations of machinery.

It is necessary to take into account the full national economic effect of fundamentally new machinery. This does not mean just the direct economic effect, which is expressed in the savings in wages and deductions for social insurance, a reduction in outlays of material resources, and an increase in the return on assets. The field of realization of the effect of new generations of machinery is substantially broader. It includes a savings in society's outlays for the reproduction of the labor resources that are freed up and for the reproduction and conservation of natural resources, additional revenues from the export of competitive Soviet technology, an improvement in the technical level and quality of products that are produced, and finally, the systematic effect that arises with the production and use of complementary machinery systems.

However, existing methods for evaluating the effectiveness of new machinery are based in large part only on the direct economic effect. Institutes of the USSR Academy of Sciences and the State Committee for Science and Technology have begun working out a new set of methods that are supposed to answer more fully to conditions of a revolutionary turning point in machinery and to reflect its socioeconomic consequences. This work must now be sped up.

In evaluating the national economic effectiveness of new generations of machinery it is very important to correctly take into account the time factor and the unevenness of the effect's distribution throughout phases of the scientific and technological cycle. In our view, it is possible to identify five such phases in the life of each generation.

In the first phase, outlays are made for research and development and the creation and testing of experimental prototypes and there is not yet any output.

In the second phase--the phase of putting the new machinery into production--large outlays are required for the reconstruction of enterprises, the preparation of production, the arrangement of cooperative relations and the training of personnel; since little output is produced, its unit-cost is high.

In the third phase, the production of the fundamentally new machinery grows at a rapid pace, it is put to use in more and more new spheres, and unit-cost and price drop rapidly.

The fourth phase is distinguished by the relatively stability of the dynamics of the production volume, outlays and effectiveness. In this phase (which

is the longest), the fundamentally new technology turns into a traditional technology.

Finally comes the fifth phase, at which the output becomes so outmoded and obsolete, its effectiveness drops off sharply, and it is subject to removal from production.

In order that progress be continuous, it is necessary to begin to develop and put into production a new and more effective generation at no later than the third phase of the preceding generation.

In evaluating the national economic effect of a new generation of machinery, it would be incorrect to apply all outlays for developing it and initially putting it into production, or the higher outlays of the first period of production, to the articles that are produced during this period. It would be more correct to apply the entire sum of the economic effect in all spheres in which the new-generation machinery is used to the sum of outlays for its development, production and use.

The CPSU Central Committee and USSR Council of Ministers' recent decree "On the Broad Dissemination of the New Methods of Economic Management and Intensification of their Influence on the Acceleration of Scientific and Technical Progress" stipulates that the indices of the acceleration of scientific and technological progress should be an organic part of all sections of the state plan and should become its basis, with a view to bringing about a transition to fundamentally new machinery and technological systems. The price system occupies an important place in the accomplishment of this strategic task.

#### The Role of Prices.

Putting a new generation of machines into production requires a radical replacement of existing equipment, the reconstruction of production and the retraining of personnel. This usually causes a temporary deterioration of economic indices. Often those who are content with partial improvements in traditional machinery come out ahead.

To a certain extent this contradiction is overcome by including in production associations' (or enterprises') volume of sold output the cost of the work on putting new machinery into production that has been paid for with money allocated from the unified fund for the development of science and technology. However, this provision only partially compensates for outlays for initially putting new generations of machinery into production. The problem is that the increased outlays of the initial period of the production of fundamentally new articles that have been put into production for the first time in the USSR (except for the costs of putting them into production) are not reimbursed out of the unified fund for the development of science and technology but are included in the temporary price. And increasing the cost of such articles for the user precisely during the period in which they are still unfamiliar and may not be distinguished by sufficient dependability narrows the sphere of their use.

This is evident from the fate of many types of fundamentally new machinery and technology for which the process of being put into production and widely adopted has been excessively dragged out: units for the continuous smelting of steel, household microwave ovens and others. At the same time, the average period required to produce machinery-industry products and put them into use has become unjustifiably long. The percentage of machinery and equipment in production for more than 10 years has risen. Only 2.3 percent of all the machines and equipment used in industry is written off over the course of a year.

It was noted at the CPSU Central Committee's conference on questions of accelerating scientific and technological progress that the share of obsolete fixed assets, especially machinery and equipment, that is taken out of use should be doubled.

In order to enhance the effect of prices on accelerating the updating of machinery, a new decree of the CPSU Central Committee and USSR Council of Ministers establishes that for articles in the highest quality category price markups are to be applied (depending on the economic effectiveness of these articles) in amounts of up to 30 percent of the wholesale price. If, however, at the time of certification the article is assigned to the first quality category, a markdown in the wholesale price is applied to the article: 5 percent in the first year, 10 percent in the second and 15 percent in the third (up to 70 percent of the sum of the markdown is reimbursed out of the material incentive fund).

Prices that are differentiated according to the level of articles' innovativeness should play a prominent role in the mechanism for the development and putting into production of new generations of machinery.

As is known, from the very start of the designing of a new article a ceiling price is determined. It is used for substantiating the effectiveness of producing and utilizing the future machinery. In calculating the ceiling price of a new generation of machinery it would be advisable to take into account the specific features of the formation and dynamics of its cost: reimbursement out of a centralized fund of the costs of putting it into production and of the higher costs of the first two or three years of production; the consideration of all the constituent elements of the complete national economic effect; determination of ceiling prices for the complex of machines forming the new generation; the differentiation of ceiling prices among the principal spheres of use of the fundamentally new machinery and the different periods of its production (staggered ceiling prices). Then the ceiling prices, in essence, will perform the function of design and forecasting prices and will become a more reliable instrument for plan and design calculations.

Improving price formation for new generations of machinery creates the prerequisites for the broad application of staggered prices (which, unfortunately, were eliminated from the final version of the methods for the determination of wholesale prices for new production-technological output that were confirmed by the USSR State Committee on Prices in December 1982). Starting in 1986 normative periods for the production of machinery-industry articles

will be introduced. In order to work them out it will be necessary to study the frequency with which generations are replaced in the principal areas of machinery. This will create an informational and normative basis for determining staggered prices that will provide incentives for attaining the optimal production volumes and reducing the unit-cost of new generations of machinery.

The stages of prices (or of markups and markdowns in prices) should ensure a higher level of profitability in the third phase of the cycle when unit-cost drops rapidly and the consumer properties of output are improved; the normative level of profitability in the fourth phase, when unit-cost and quality are comparatively stable and reflect the socially normal level; and a reduced level of profitability in the fifth phase in order to make it disadvantageous to continue the production of (and especially, to further improve) an obsolete generation of machinery.

In our view, a great deal needs to be changed in the procedures for certifying output and establishing incentive markups in wholesale prices for articles in the highest quality category. In the first six months of 1985 the share of such articles in the total volume of output subject to certification exceeded 45 percent. However, evaluations of the technical level of machinery-industry output that are periodically carried out by the State Committee for Science and Technology, as well as the practice of supplying this output for export, show that in actual practice the percentage of competitive output meeting the requirements of the world market is considerably smaller.

It would be more objective to evaluate actual correspondence to the best foreign models when quality certification is carried out and incentive markups are established. The time has come to assign pioneering machinery that is based on Soviet inventions and exceeds the highest foreign level to a special category and to provide additional incentives for it.

In our view, changes also need to be made in the practice of planning and financing scientific and technical progress: an abandonment of wholesale prices that go unchanged for many years and become, in time, ossified accounting categories that are divorced from real outlays; and an increase in the sizes and sphere of use of branch and interbranch funds intended for offsetting the costs of putting a new generation of machinery into production and the outlays for its initial period of production.

The creation of a scientifically substantiated and effectively operating economic mechanism for managing the process of developing new generations of machinery and putting them into production is an essential prerequisite for and important factor in the implementation of a unified scientific and technical policy.

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